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OUR TWO BRAINS.

By Richard A. Proctor.

(*Continued from p.* 230.)

THE next point on which Dr. Wigan insisted, was the fact that among insane persons we often recognise two different minds, either one sane and the other insane, or both insane but in different degrees. No one who has studied the literature of insanity can fail to recall instances; but I shall venture to quote in illustration a passage from an American narrative, "The Hoosier Schoolmaster," based, I am assured, on an actual case which came under the notice of the author of that pleasant story.

"Ralph stood looking into a cell, where there was a man with a gay red plume in his hat and a strip of red flannel about his waist. He strutted up and down like a drill-sergeant. 'I am General Jackson,' he began; 'people don't believe it, but I am. I had my head shot off at Bueny Visty, and the new one that growed on isn't nigh so good as the old one; it's tater on one side. That's why they took advantage of me to shut me up. But I know some things. My head is tater on one side, but it's all right on t'other. And when I know a thing in the left side of my head I know it.'" (This illustrates a point on which Dr. Wigan specially insisted. An insane patient knows he is insane. He will put forward insane ideas, and immediately after having put them forward he will say, "I know they are insane." "The lunatic is at one and the same time perfectly rational," says Brown-Séquard, "and perfectly insane." Dr. Wigan concluded, like the poor lunatic of the Indiana workhouse, that in such cases one-half of the brain is normal and the other half diseased; one-half employs the faculties in a normal way, the other half employs them in a wrong way.) The crazy pauper is called on to give evidence, or rather he introduces himself to the judges, with the remark that one side of his head being "sound as a nut," he "kin give information." He refuses to be sworn, because "he knows himself." "You see when a feller's got one side of his head tater, he's mighty onsartin like. You don't swear me, for I can't tell what minute the tater side'll begin to talk. I'm talkin' out of the lef' side now and I'm all right. But you don't swar me. But if you'll send some of your constables out to the barn at the poor-house and look under the hay mow in the north-east corner, you'll find some things maybe as has been missin' for some time. And that a'n't out of the tater side neither." The exactness of the information, with the careful references to locality and time, as also the suggestion of the proper course of action—not merely "go and look," but send some of your constables, &c.—all this illustrates well the perfect contrast often existing between the two states in which a so-called lunatic exists.

There are cases, however, which are even more interesting, in which two different mental conditions are presented, neither of which presents any indication of mental disease, except such as might be inferred from the completeness of the gap which separates one from the other. Dr. Brown-Séquard gives the following account of a case of this kind. "I saw a boy," he says, "at Notting-hill, in London, who had two mental lives. In the course of the day, generally at the same time, but not constantly, his head was seen to fall suddenly. He remained erect, however, if he was standing, or if sitting he remained in that position; if talking, he stopped talking for a while; if making a movement he stopped moving for a while; and after one or two minutes of that state of falling forward or drooping of the head (and he appeared as if falling asleep suddenly, his eyes closing), immediately after that his head rose, he started up, opening his eyes, which were now perfectly bright, and looking quite awake. Then, if there was anybody in the room whom he had not previously seen, he would ask who the person was, and why he was not introduced to him. He had seen me a great many times, and knew me very well. Being with him once when one of these attacks occurred, he lifted his head, and asked his mother, "Who is this gentleman? Why don't you introduce him to me?" His mother introduced me to him. He did not know me at all. He shook hands with me, and then I had a conversation with him as a physician may have with a patient. On the next instance, when I was present during an attack of this kind, I found that he recognised me fully, and talked of what he had spoken of in our first interview. I ascertained from what I witnessed in these two instances, and also (and chiefly, I may add) from his mother, a very intelligent woman, that he had two lives in reality—two mental lives—one in his ordinary state, and another occurring after that attack of a kind of sleep for about a minute or two, when he knew nothing of what existed in his other life. In his abnormal life, the events of his normal life were forgotten—his ordinary life became a blank.* He knew

* I have been compelled slightly to modify the report of Dr. Brown-Séquard's statement. Though manifestly a report taken by shorthand writers, and intended to be *verbatim*, there are places where it is clear that either a part of a sentence has been omitted or some words are wrongly reported. I speak from experience in saying that even in America, where lectures are much more carefully reported than in England, mistakes are not uncommon. The enterprise of the *New York Tribune*, in taking full reports of lectures considered noteworthy, is a well-known and most creditable feature of American journalism. But it is a mistake to suppose that reports, even if actually *verbatim*, can exactly represent a lecturer's meaning. A speaker, by varieties of inflection, emphasis, and so on, to say nothing of expression, action, and illustration, can indicate his exact meaning whilst using language which, written in the ordinary manner, may appear indistinct and confused. Thus a most exact and carefully-prepared lecture may appear loose and slipshod in the report. This applies to the case where a lecturer speaks at so moderate a rate that the shorthand writers can secure every word, and is true even when in writing out their report they make no mistake, though it seldom happens, as any one will readily understand who is acquainted with the stenographic art. But the case is much worse if a lecturer is a rapid speaker. A reporter is compelled to omit words and sentences occasionally, and such omissions are absolutely fatal to

nothing during the second state about what had occurred in previous periods of that same condition; but he knew full well all that had occurred then, and his recollection of everything was as perfect then as it was during his ordinary life concerning the ordinary acts of that life. He had, therefore, two actually distinct lives, in each of which he knew everything which belonged to the wakeful period of that life, and in neither of which did he know anything of what had occurred in the other. He remained in the abnormal—or rather the less usual state, for a time which was extremely variable—between one and three hours, and after that he fell asleep, and got out of that state of mind pretty much in the same way that he had got into it. I have seen three other cases of that kind, and as so many have fallen under the eyes of a single medical practitioner, such cases cannot be extremely rare."

The circumstances just described will probably remind the reader of cases of somnambulism, during the recurrence of which the person affected recalls the circumstances which had taken place during the previous attack, of which in the intervening wakeful state he had been altogether oblivious. Dr. Carpenter, in his fine work on "Mental Physiology," records several instances.* Forbes Winslow cites cases in which intoxication has produced similar effects; as, for instance, when a drunken messenger left a parcel in a place which he was quite unable to recall when sober; but, becoming drunk again, remembered where it was, and so saved his character for honesty through the loss of his sobriety.

It may fairly be reasoned, however, that the actual duality of the brain is not demonstrated or even suggested by cases such as these last. In fact, it is not difficult to cite evidence which, if interpreted in the same way, would show that we have three brains, or four or more. Thus Dr. Rush, of Philadelphia, records that "an Italian gentleman, who died of yellow fever in New York, in the beginning of his illness spoke English, in the middle of it French, but on the day of his death only Italian." It is manifest that the interpretation of this case, and therefore of others of the same kind, must be very different from that which Brown-Séquard assigns, perhaps correctly, to the case of two-fold mental life above related. Knowing as we do how greatly brain action depends on the circulation of the blood in the vessels of the brain, we can be at no loss to understand the cases of the former kind, without requiring a distinct brain for the different memories excited.* In the same way, possibly we might explain the well-known case of an insane person who became sane during an attack of typhus fever at the stage when sane persons commonly become delirious, his insanity returning as the fever declined. But we seem led rather to Dr. Brown-Séquard's interpretation, by a case which recently came under discussion in our law courts, where a gentleman whose mind had become diseased was restored to sanity by a fall which was so serious in its bodily consequences as to be the subject of an action for damages.

(To be continued.)

the effect of a lecture, regarded either as a demonstration or as a work of art. Still more unfortunate will it be for a lecturer if he should be carried away by his subject, and pour forth rapidly the thoughts which have come uncalled into existence. Take the most eloquent passage from the pages of Sir J. Herschel, Tyndall, or Huxley, strike out as many words, not quite necessary to the sense, as shall destroy completely the flow and rhythm of the passage, omit every third sentence, and leave the rest to be slowly read by a perplexed student, and the effect will correspond to the report of passages which, as delivered, formed the most effective part of a lecture. The result may be a useful mental exercise, but will surely not be suggestive of fervid eloquence. The student of such reports will do well to read, as it were, between the lines, taking what appears as rather the symbol of what was said than its actual substance. So read such reports are of great value.

* One of these, however, is scarcely worthy of a place in Dr. Carpenter's book. I refer to the narrative at p. 596, of a servant-maid, rather given to sleep-walking, who missed one of her combs, and charged a fellow-servant who slept in the same room with stealing it, but one morning awoke with the comb in her hand. "There is no doubt," says Dr. Carpenter, "that she had put it away on a previous night without preserving any waking remembrance of the occurrence; and that she had recovered it when the remembrance of its hiding-place was brought to her by the recurrence of the state in which it had been secreted." This is not altogether certain. The other servant might have been able to give a different account of the matter.

DREAMS:

THEIR PLACE IN THE GROWTH OF PRIMITIVE BELIEFS.

By Edward Clodd.

X.

THE existence of the ghost-soul or other-self being unquestioned, the inquiry follows, where does it dwell? Like the Trolls of Norse myth who burst at sunrise, the flitting spirit vanishes in the light and comes with the darkness; but what places does it haunt when the quiet of the night is unbroken by its intrusion, and where are they?

The answers to these are as varied as the vagaries of rude imagination permit. We must not expect to find any theories of the soul's prolonged after-existence among races who have but a dim remembrance of yesterday and but a hazy conception of a to-morrow. Neither, among such, any theories of the soul abiding in a place of reward or punishment, as the result of things done in the body. Speaking of the heaven of the red man, Dr. Brinton remarks that "No contrast is discoverable between a place of torment and a realm of joy; at the worst but a negative castigation awaited the liar, the coward, or the niggard." Ideas of a devil and a hell are altogether absent from the barbaric mind, since it is obvious that any theory of retribution can arise only when man's moral nature had so developed as to awaken questions about the government of the universe, and to call another world into existence to redress the wrongs and balance the injustices of this. His earliest queries were concerned with the whereabouts of the soul more than with its destiny, and it was, and still is among the lower races, thought of as haunting its old abode or the burial-place of its body, and as acting very much as it had acted when in the flesh. The custom of placing articles whose *manes* would serve its supposed needs is an evidence of this. The shade of the Algonquin hunter chases the spirits of the beaver and the elk with the spirits of his bow and arrow, and stalks on the spirits of his snow-shoes over the spirit of the snow. Among the Costa Ricans the spirits of the dead are supposed to remain near their bodies for a year, and the explorer Swan relates that when he was with the North-Western Indians he was not allowed to attend a funeral, lest he offended the spirits hovering round; whilst the Indians of North America often destroy or abandon the dwellings of the dead, the object being to prevent the ghost from returning, or to leave it free so to do. But it is

* "No simple term," says Sir Henry Holland, "can express the various effects of accident, disease, or decay, upon this faculty, so strangely partial in their aspect, and so abrupt in the changes they undergo, that the attempt to classify them is almost as vain as the research into their cause." The term "dislocation of memory" was proposed by him for the phenomena of complete but temporary forgetfulness.

needless to multiply illustrations of a belief which has been persistent in the human mind from the dawn of speculation about the future of the soul to the present day. The barbarians, who think that the spirits of the dead move and have their being near the living, join them on their journeys, and sit down, unseen visitants, at their feasts (to be driven off, as among the Eskimos, by blowing the breath), are one with the multitudes of folks in Europe and America who, sorrowing over their dead, think of them as ministering with unfelt hands and as keenly interested in their concerns.

> We meet them at the doorway, on the stair,
> Along the passages they come and go,
> Impalpable impressions on the air,
> A sense of something moving to and fro.

The Ojibway, who detects their tiny voices in the insect's hum, and thinks of them as sheltering themselves from the rain by thousands in a flower, as sporting by myriads on a sunbeam, is one with the Schoolmen who speculated on the number of angels that could dance on a needle's point, and with Milton in his poetic rendering of the belief of his time, that

> Millions of spiritual creatures walk the earth
> Unseen, both when we wake and when we sleep.

The Hottentot who avoids a dead man's hut lest the ghost be within, is one with the believers in haunted houses, in banshees, wraiths, and spectres. Such as he should not be excluded as "corresponding members" of the Society for Psychical Research in the invitations which its committee issues to folks who have seen apparitions, and slept, or tried to sleep, in the dreaded chamber of some moated hall of mystery.

If we look in vain for any consistency of idea or logical relation in barbaric notions, our wonder ceases at the absence of these when we note the conflicting conceptions entertained among intelligent people. But the underlying thought is identical. The examples given in a foregoing paper on the belief in the passage of the soul into other human bodies, into animals and stones, strengthened as this is by the likeness in mind and body between children and dead relatives, by the human expression noted on many a brute, by the human shape of many a stone, show how the theory of the soul as nigh at hand finds many-sided support. In this belief, too, lie the germs of theories of successive transmigrations elaborated in the faiths of advanced races, when the defects of body and character were explained as the effects of sin committed in a former existence.

Next in order of conception appears to be that of the soul as living an independent existence, an improved edition of the present, in an under or upper world, into which the dead pass without distinction of caste or worth.

The things dreamed about respecting the land of spirits and their occupations are woven of the materials of daily life. Whether to the sleeping barbarian in his wigwam, or to the seer banished in Patmos; whether to the Indian travelling in his dreams to the happy hunting-ground, or to the apostle caught up in trance into paradise; earth, and earth alone, supplies the materials out of which man everywhere has shaped his heaven. Her dinted and furrowed surface; valleys and mountain-tops; islands sleeping in summer seas, or fretted by winter storms; cities walled and battlemented; glories of sunrise and sunset; gave variety enough for play of the cherished hopes and imaginings of men. If we collect any group of barbaric fancies, we find, speaking broadly, that a large proportion have pictured the home of souls as in the west, towards the land of the setting sun. Seen from many a standpoint to sink beneath river, lake, or ocean, which for untutored man enclosed his world, it led to the myth of waters of death dividing earth from heaven, which the soul, often at perilous risk, must cross. Such was the Ginnunga-gap of the Vikings, the great water of the Red Indians, the Vaitarani of the Brahmans, the Stygian stream of the Greeks, and the Jordan of the Christians, that flows between us and the Celestial City "where the surges cease to roll." The sinking of the sun below the horizon obviously led to belief in an under-world, whither the ghosts went. Barbaric notions are full of this, and the lower culture out of which their beliefs arose is evidenced in the Orcus of the Romans, the Hades of the Greeks, the Helheim of the Norsemen, the Sheol of the Hebrews, and the Amenti of the Egyptians, the solar features of which last are clearly traceable in their doctrine. Among the Hebrews, Sheol (translated, curiously enough, thirty-one times as "grave," and thirty-one times as "hell" in our Authorised Version) was a vast cavernous space in which the shades of good and bad alike wandered —"the small and great are there, and the servant is free from his master." It is akin in character to the Greek Hades, where they "wander mid shadows and shade, and wail by impassable streams." As ideas of a Divine Rule of the world grew, its manifestations in justice were looked for, and the mystery of iniquity, the wicked "flourishing like a green bay tree," led to the conception of a future state, in which Lazarus and Abraham would change places. Sheol thus became, on the one hand, a land of delight and repose for the faithful, and, on the other hand, one of punishment for the wicked.

Persian, and still older, influences had largely leavened Hebrew conceptions, and local conditions in Judea added pungent elements. The Valley of Hinnom, or Gehenna, "the place where lie the corpses of those who have sinned against Jehovah, where their worm shall not die, neither their fire be quenched;" the dreary volcanic region around the Dead Sea, with its legend of doomed cities, supplied their imagery of hell with its lake of fire and brimstone. And, as the belief travelled westward, it fell into congenial soil. The sulphurous stench around Lacus Avernus, the smoke of Vesuvius, Stromboli, and Etna, wreathed themselves round the hell of Christianity, and the under-world of barbaric myth, and from Talmudic writer to classic poet, to Dante and to Milton, the imagination exhausted the material of the horrible to describe the several tortures of the damned. The hell of our northern forefathers remained below the flat earth, but the cold, misty Niflheim melted away before the fiery perdition of Christian dogma. And, in the region bordering thereon, the *limbus patrum*, the *limbus infantum*, &c., we have the survival of belief in separate hells characteristic of the Oriental religions, and of the sub-division of the lower world in more rudimentary religions.

Beyond the narrow horizon which bounded the world of the ancients, lay the imaginary land of the immortals, the Blessed, the Happy, the Fortunate Isles. But as that horizon enlarged, the Elysian Fields and Banquet Halls were transferred to an upper sphere. In the wonder aroused by the firmament above, with its solid-looking vault across which sun, stars, and clouds traversed; in the place it plays in dreams of barbarian and patriarch, when the sleeper is carried thither; in its brightness of noonday glory as contrasted with the dark sun-set under-world, we may find some of the materials of which the theory of an upper world, a heaven ("the heaved") is made up. There the barbarian places his paradise to which the rainbow and the Milky Way are roads; there he meets his kindred, and lives where cold, disease, and age are not, but everlasting

XUM

summer and summer fruits. There, too, for the conceptions of advanced races are drawn from the same sources, the civilised peoples of Europe and America have placed their heaven. And, save in refinement of detail incident to intellectual growth, there is nothing to choose between the earlier and the later; the same gross delights, the same earthborn ideas are there, whether we enter the Norseman's Valhalla, the Moslem's Paradise, or the Christian's New Jerusalem.

PLEASANT HOURS WITH THE MICROSCOPE.

By Henry J. Slack, F.G.S., F.R.M.S.

THERE is no class of animals which exhibit a more curious variety of mouth organs than the insects, and some of the most remarkable belong to the dipterous, or two-winged group, roughly known as flies. They all feed upon fluid matter, but their habits are so different, as to require, or to speak more philosophically, to result from, peculiar modifications of the mandibles, maxillæ, lips, tongues, &c. The dipters are extremely numerous in species and individuals; many of them being the most annoying and mischievous plagues. Of the whole lot it may be said that their two wings cannot be folded, and are accompanied at the base by a pair of little expansions called alulets, and that they have two poisers, filaments terminating in knobs, which represent the lower or absent pair of wings, or at least are generally thought to have that character.

The divisions of insects into orders founded upon peculiarities of their wings bring together species whose mouth organs are strikingly different, and this is very conspicuous amongst the dipters. A gnat, for example, is a pumper or sucker, its mouth apparatus includes instruments for making holes in its victims, and tubes to suck up their blood. Common house-flies, bluebottles, and many others are lickers or lappers; and the most wonderfully provided with a lapping tongue is, so far as the writer has seen, the daddy-longlegs (*Tipula oleracea*), grouped with the gnats by entomologists. The bee is a lapping insect, but it does its feeding work with a sweep of its mopping tongue, as was explained in a former paper. The blow-flies, or bluebottles, and flies more or less like it, lap in a different way. Fig. 1 shows in outline the horse's head sort of shape presented by its proboscis when its two lobes are pressed together. Fig. 2 shows them when they are opened to lap up a fluid, as may be easily seen by putting one in the tubular live-box

Fig. 1.

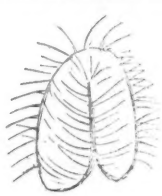


Fig. 2.

described in a former paper, and supplying the creature with a drop of honey, or syrup, or blood. The blow-fly does not possess by any means the simplest form of this sort of proboscis, but it is a good one to study, because the insect is very common, and very ready to exhibit its mode of using the instrument.

A student will do well to mount one of these organs in Canada balsam, after carefully washing it, but avoiding opening and spreading out its two lobes. It should be well examined in this position, which shows it to be supplied with a number of tubes, at first sight like the breathing tracheæ, but the rings are not complete. There are gaps in them which allow a fluid to enter.

It is well worth while to buy one of Topping's beautiful preparations of the blow-fly proboscis, with the lobes open and extended. It is a work of great skill to produce anything so perfect in its way, and the object is singularly beautiful with dark-ground illumination. It is also desirable for the student to prepare slides with the lobes expanded, and he will then see parts which Topping cuts away to make others plainer. Each lobe has thirty pseudotracheæ, broad at their commencement, as they spring from larger tubes, and getting gradually slender towards their tips. No published drawings of the proboscis, in accessible books, can be regarded as satisfactory. It would take a clever artist a good while to make a good likeness, and the engraving would be difficult to execute in a satisfactory way. Fig. 3 shows portions of the pseudotracheæ magnified about 500 times linear, and represented in plan. In a perspective view the tubular character would appear. Each pseudotrachea may be likened to a gutter, but the two edges can be brought closer together when the two lobes are in contact.

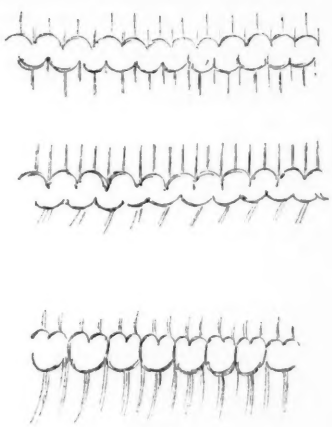


Fig. 3.

Common flies and bluebottles are omnivorous feeders upon things that are either fluid or easily dissolved. If they attack a bit of sugar, they can scrape it with teeth.

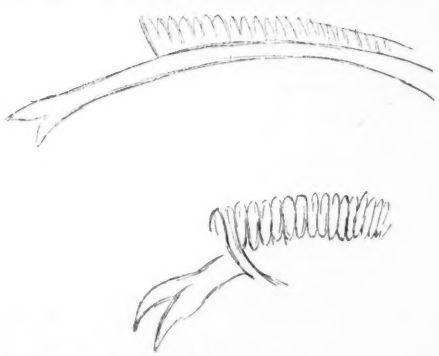


Fig. 4.

When the proboscis is spread out with the lobes open, these instruments are seen in the median line. Mr. Lowne, in his book on "The Anatomy of the Blow-fly," says there are from fifty to sixty of these bidentate tools, and Mr.

Suffolk, whose paper will be found in the *Monthly Microscopical Journal* for April, 1869, saw marks of their work upon sugar comfits with which he fed them. Their scraping action is accompanied with an outflow of saliva by which the sugar particles are dissolved. The smaller pseudo trachæ are connected with larger ones, and the fluid that is sucked up runs into the mouth.

Fig. 5.

At this time of the year, large flies, looking so much like drones that they are commonly taken for them, are frequently found on the windows of country houses. They are drone-flies, with a larger and differently shaped proboscis to that of the blow-fly. A rough outline of its appearance is shown in Fig. 5. The pseudo-tracheæ are much finer and more numerous. They are also nearer complete tubes than in the blow-fly, and I think act as such when the two lobes are in contact. This insect is not omnivorous. It would not touch a droplet of meat soup as a blow-fly would have done, but worked vigorously at one of honey. The blow-fly thrusts its proboscis forward in front of its head in feeding. The drone-fly likes to work it at right angles to the line of its body. Putting the insect in a wide test-tube, is a good way of seeing the proboscis in action. When the lobes are open and pressed against the glass to lap up the honey, a ripple is distinctly seen round its margin. When a certain quantity is taken up, the instrument is drawn back, and the lobes brought together. This must cause a pressure on the tubes, and drives the fluid into the mouth.

The drone-fly is furnished with piercing and pumping tools to get at nectar which the proboscis could not reach. I do not know what flowers it operates upon in this way. It is fond of the Michaelmas daisy, and reaches its nectar by thrusting the proboscis down the tube of the flower. When engaged at its meals it is not readily frightened, and a quiet observer can stand by and watch the process with a long-focussed lens.

If formed by a gradual process of development, a long time must have elapsed before so complicated an organ as the proboscis of the common flies, blow-flies, and drone-flies came into being. If we look to what advantage this form of mouth-apparatus bestows upon the creatures, we find the pseudo-tracheæ act as filters as well as conduits. Unlike the biting insects, the beetles, no solid particles suit these creatures, and the varying delicacy of the pseudo-tracheæ adapts them to different fluids. Perhaps the blow-fly and his relations may take up thicker fluids than the drone-fly, and the daddy-longlegs, to which reference will be made in the next article, only dines upon those which are very limpid.

DICKENS'S STORY LEFT HALF TOLD.

A QUASI-SCIENTIFIC INQUIRY INTO

THE MYSTERY OF EDWIN DROOD.

By Thomas Foster.

(*Continued from page* 298.)

THE next chapter brings us to Rosa again, at Miss Twinkleton's. We may remark here, that no note in the opening music suggests the tragic tone which we should expect were Rosa sorrowing for Edwin's death. We presently find her full of horror at Jasper's pursuit, but even then there is no suggestion of any feeling that Drood is dead. On the other hand, there are passages strongly suggestive of the contrary. She speaks of fearing to open Edwin's "generous eyes," of keeping the truth from him "for his own trusting, good, good sake," as though he were still alive. Of course the words would serve well enough were he dead; yet is there a subtle distinction between them and those she would more naturally have used if she had deemed him dead. Just as, later, when she says to Grewgious, "His uncle has made love to me," we feel that she would not have said this, but "Mr. Jasper has made love to me," were Jasper's nephew really dead; so in this interview we feel that Rosa knows Drood to be alive; though she does not know how Jasper had dealt towards the man whom he pretended to love so warmly.

The next chapter—"Rosa's Flight"—is still more significant. After showing the state of Rosa's mind in regard to Jasper, it tells us that she determined to go to her guardian, and to go immediately. She knows that he has the power not only to protect her against Jasper, but to check the vile scheme which Jasper has threatened to carry out against Neville Landless. Noting in passing that she finds Mr. Grewgious at the open window, his shaded lamp placed far from him on a table in a corner—manifestly maintaining his watch over Neville—we see her appealing at once to Mr. Grewgious for protection. Let us look a little carefully into this part of the story. He asks her how she came, and on her telling him, he asks why she had not written to him to come and fetch her. Clearly it had been arranged that if any new development required it she was to write to him. Her answer is remarkable: "I had no time. I took a sudden resolution. *Poor, poor Eddy!*" And Mr. Grewgious's reply is as strange. "Ah, poor fellow, poor fellow!" He has asked her why she came, and she says, "Poor, poor Eddy." Yet he finds the reply full of meaning, and instead of asking her how it bears on his question, simply echoes her thought! What can this mean? "I had no time. I took a sudden resolution. *Poor, poor Eddy!*" Clearly there is reference here to something which had been arranged beforehand between Rosa and Mr. Grewgious. Doubtless when he told her Edwin was alive, but that she must keep the knowledge of this to herself, he told her also of the love for her which had sprung into existence in Eddy's heart with the recognition of her real nature. *She*, not Eddy, had decided that she and Edwin could never be man and wife. If Mr. Grewgious had told her, as he doubtless did, that Edwin loved her, she must have answered that she loved him only as a brother. But, if Mr. Grewgious had suggested that perhaps with time a warmer feeling might find growth in her heart, and that did this chance he would wish her to

tell *him* that one day Edwin might be more to her than a brother, she would not have rejected the thought, though her own heart might say nay to it. Doubtless there was a reference to some such thought when Mr. Grewgious asked why she had not written to him. "Poor, poor Eddy!" from her meant that her sudden resolution had no relation to Edwin's love; and, "Ah, poor fellow, poor fellow!" from Mr. Grewgious was the natural answer to what her sorrowful words implied, for he, too, had loved one so like Rosa that he had just mistaken Rosa for her ("I thought you were your mother"), and loved without hope, like Edwin.

And then she goes on, without further question from Mr. Grewgious, to say why she has suddenly come to him. "His uncle" (the uncle of the living Edwin you are sad for) "has made love to me. I cannot bear it. I shudder with horror of him, and I have come to you to protect me and all of us from him, if you will?" Not, "if you *can*." She knows he can, for she knows he can at any moment announce Edwin Drood to be alive. But, "if you *will*." And Mr. Grewgious makes no pretence of want of power to save Rosa and all of them. "I will," he says. "Damn him!

> "Confound his politics,
> Frustrate his knavish tricks,
> On Thee his hopes to fix—
> Damn him again"

(The whole of this scene between Rosa and Grewgious is worthy of Dickens's very best days, for quiet humour and pathos, fun and feeling.)

He is not even in a hurry to learn further particulars about Jasper's threats, so sure is he that he holds him safely. After the extraordinary outburst, in which he shows at once his detestation of Jasper and his contempt for the villain's plots, we have the laughable talk about Bazzard. Most certainly Dickens does not wish us to suppose that change of employment from clerkly duties to detective work (though no doubt Bazzard is employed in detective work) has suddenly changed the character of Bazzard. Throughout the talk with Rosa ("Let's talk," says Grewgious, quaintly) Bazzard is presented as the selfish, conceited dolt he had shown himself during the conversation with Edwin.

Then, after three pages of talk, Grewgious says, "And now, my dear, if you are not too tired to tell me more of what passed to day—but only if you feel quite able—able" [observe how Dickens emphasizes Grewgious's coolness about Rosa's news] "I should be glad to hear it. I may digest it the better if I sleep on it to-night." As she gives the account, it is to be noticed that Mr. Grewgious pays special attention to the part relating to Helena and Neville, which parts he "begged to be told a second time." He thanks her, takes her to the open window, showing her where Neville and Helena live" (and showing the attentive reader that, at the beginning of the scene, when Rosa entered, he had been keeping watch on them), and in response to her very natural request that on the morrow she might go to Helena, answers, doubtfully, "I should like to sleep on that question to-night." This last point is noteworthy, for it shows how largely the thought of the Landlesses enters into the plans of Mr. Grewgious—which are those of Edwin Drood—for bringing Jasper to a very bitter reckoning.

(To be continued.)

The International Prime Meridian Conference re-assembled on Monday, and adopted a resolution in favour of Greenwich as the standard meridian. The representatives of France and Brazil did not vote, and the San Domingo Delegate voted against the resolution.

THE EARTH'S SHAPE AND MOTIONS.

By Richard A. Proctor.

CHAPTER V.—THE EARTH'S ROTATION.

I HAVE often been asked what is the most striking and convincing proof of the earth's rotation. My answer has always been—the earth's revolution. The fact that the earth revolves round the sun is founded on much stronger evidence than any we have respecting the earth's rotation, considered separately. If there is one fact in the whole range of science which has been more completely demonstrated than any other, it is that of the earth's revolution. Now, accepting that fact, we are forced to accept with it the earth's rotation, because it is obviously absurd to suppose that while the earth revolves in an enormous orbit around the sun once in every year, the whole solar system, including the sun himself, revolves round the earth once in every day.

But the various facts of astronomy are so interwoven, that one is compelled, whatever order one may select for exhibiting them, to present some first, which in reality owe their establishment to others that must be dealt with later. I could not conveniently deal with the earth's revolution before considering her rotation, because before I consider those motions of the sun and planets which establish the fact of the earth's revolution, I must set apart, so to speak, the motions due to the earth's rotation.

Fortunately, however, there are many direct evidences of the earth's rotation, which, while not so striking as that founded on her revolution, are yet sufficiently convincing when rightly apprehended. These proofs are:—First, the diurnal motion of the heavens; secondly, the varying effects of gravity; thirdly, observed peculiarities in the descent of bodies from great heights; fourthly, observed peculiarities in the motion of a free pendulum; fifthly, experiments with the gyroscope; sixthly, precession and nutation; and lastly, the rotation of the planets. I shall take these proofs in their order, dealing with them at greater or less length, according as their importance may seem to warrant.

First, then, as respects the diurnal motion of the heavens:—We have seen what the nature of this motion is. It is perfectly regular for the fixed stars, slightly variable for the planets, the sun, and the moon; but undoubtedly, so far as the question of the earth's rotation is concerned, these slight irregularities may be neglected. We have only to consider that regular and persistent rotation which the stellar motions present to us, and to inquire whether it is more probable that the earth rotates from west to east, within the sphere of the fixed stars, or that the sphere of the fixed stars rotates from east to west around the earth.

Now, in the first place, we have proved that our earth really is a sphere, whereas, though we speak of the sphere of the fixed stars, we have no knowledge at all what the actual figure of the sidereal system may be. So, in so far as sphericity is suggestive of rotation, we have far better reason for believing that the earth rotates than that the stars do. But, secondly, we have proved that the earth is very small indeed compared with the distances which separate her from the fixed stars. So that as far as that explanation is more probable which accounts for observed appearances by the smallest expenditure of motion, we again have much better reason for believing that the earth moves within the star system, and not the star system around the earth. And, thirdly, we know that the earth is hanging suspended in space, not attached at any part of its surface to any other object, and therefore *free* to rotate. We may note also in passing that the minutest

force applied tangentially to such a globe supposed initially at rest would cause it to rotate uniformly —however slowly—and if no new force were applied this rotation would continue until time should be no more. At least, then, we have a simple account to give of the earth's rotation; but when we consider the rotation of the sidereal scheme we find no simple explanation available. Are the stars rigidly bound together in some way? Then indeed they can rotate with the uniformity observed in their diurnal motion. But then we become immediately perplexed by the sun, moon, and planets, which, while partaking of the uniform diurnal rotation, have, superadded to this, motions peculiar to themselves. We must have for each of those bodies a separate sphere rotating about the same axis as the stellar sphere, each body being within its own proper sphere. If the stars are *not* thus bound together, then each travels uniformly in its proper circle, and at its proper rate round the polar axis; and instead of a single rotation accounting for the whole system of stellar motions, we require that each star of the thousands we see should travel independently on its proper diurnal path, and that path millions of miles in circuit, even by what we have already learned.

This is sufficiently difficult to believe; but when we add to this the evidence afforded by the telescope, the idea that the stars revolve diurnally round the polar axis becomes altogether incredible. In the first place, for every star visible to the naked eye, the telescope reveals thousands, each following the same law of motion which is observed among the lucid stars. Secondly, the careful telescopic examination of the heavens has revealed the fact that the so-called fixed stars have certain minute motions—a circumstance which suffices to show that they are not rigidly attached together in any way; so that we are compelled to dismiss the only possible conception by which the uniformity of their rotation seemed explicable. Lastly, the telescope reveals the existence of pairs of stars revolving around each other—a circumstance which yet more clearly proves that the stars, like the earth, are suspended in space, free to circle around each other or to sweep onward in solitary state, upon their several orbits.

The second proof of the earth's rotation is founded on the varying attraction of gravity in different parts of the earth's surface. We have seen that the earth's figure is that of a somewhat flattened sphere. Now without assuming the theory of gravitation as Newton propounded it, we yet know quite certainly that the earth's mass exerts an attraction upon all terrestrial bodies. A thousand experiments convince us that this attraction is appreciably uniform in any given place. The swing of a pendulum, the flight of a projectile, and many other obvious circumstances serve to prove this. Therefore, quite independently of Newton's theory, we can look on terrestrial gravity as not only an established fact, but one from which we can glean useful information.

Now, if a pendulum be set swinging at a considerable height above the earth, and its oscillation be compared with that of a pendulum at the earth's surface, gravity is found to decrease according to a certain law.

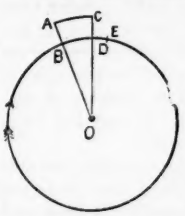
Suppose, then, we carry a pendulum from the polar regions to the equator, so that (according to what we have already learned respecting the earth's figure), the distance of the pendulum from the centre of the earth continually increases. Then it is not difficult fer the mathematician to determine according to what law gravity ought to diminish in consequence of this increased distance. I do not enter into a consideration of the mode of calculation, because it depends on principles rather too abstruse for these pages. Suffice it to say, that these principles are thoroughly well established and certain, and that they lead to the conclusion that gravity at the equator should be about 1-289th less than gravity at the poles, if we merely took into account the earth's shape.

But instead of this, gravity at the equator is found to be less than gravity at the poles (or rather than gravity as calculated for the pole from the observed gravity in high latitudes), by fully 1-195th part. Whence then can the difference arise? This difference is equal to 1-195—1-289, or 1-599, and is not much less than half the estimated decrease, so that it is a quantity far too important to be neglected.

Now, it is really calculable that the diminution of weight due to the centrifugal force at the equator, if the earth really rotates once in a sidereal day, is exactly 1-599th part. In other words, if the earth were a perfect sphere, a body at the poles would weigh more than a body at the equator in the proportion of 599 to 598, supposing the earth really to be rotating. We see that this relation actually holds:—A body at the equator weighs less by 1-599th than it should weigh on the supposition that the earth does not rotate. Thus we have direct evidence of great weight, in favour of the view that the earth does rotate.

The evidence derived from the descent of bodies from a considerable height is one of the most interesting of all the proofs of the earth's rotation. It is also, I believe, one of the least known.

The general principles on which this proof depends are very easily explained. Let B be a point on the earth's equator, O the centre of the earth. A a point vertically above B. Then, clearly, the point A moves faster (if the earth is rotating) than the point B. We see, for instance, that in the time occupied by A in passing to C, B only passes to D, and A C is obviously greater than B D. Hence, if a body be let fall from A, it will not fall directly towards B, but will be carried by the excess of its motion, somewhat towards D. In fact, if we suppose that while the body is falling from A to the ground near B, the point A is carried to C, then the point B will have been carried to D, and our falling body will have reached a point E, such that B E = A C. The small displacement D E will be all that will be noticed by the observer; and when we remember how very small the distance A B must be in all real cases, when compared with B O, it will be seen at once that D E must always be very small indeed. Still, it has been found possible, by very delicate appliances, to render sensible the displacement of a falling body towards the east (the direction of the earth's rotation). Before describing the experiments made on falling bodies, it may be well to consider the minuteness of the results to be looked for. Suppose we consider the case of a body at the equator, let fall from a height of 1,000 feet; then, according to the usual formula, the time of falling is $\sqrt{\frac{2000}{32}}$ (taking gravity at 32 for convenience); that is, the time is rather less than 8 sec. Now, in 8 sec. a point on the equator travels about $\frac{25{,}000 \times 8}{24 \times 60 \times 60}$ miles $= \frac{250}{108}$ miles $= 2{\cdot}3$ miles or thereabouts. And in order to see how much farther a point 1,000 feet above the level of the earth would travel, we have only to take the same portion of 2·3 miles, that 1,000 feet is of the earth's radiua. Thus we get (in miles) $2{\cdot}3 \div \frac{4{,}000 \times 1760 \times 3}{1{,}000}$ roughly; that is, $\frac{2{\cdot}3}{4}$ ft.: or not quite 7 inches. Now, the slightest breath of air when



the falling body was so far from the ground would suffice to cause such a displacement as this. And since it has never been found possible to secure so great a height with perfect freedom from disturbing causes, the displacement which has commonly had to be looked for is one measurable not by inches but by lines. Even the resistance of the air tends largely to diminish it.

Newton suggested this method of proving the earth's rotation, and Dr. Hooke, then Secretary of the Royal Society, carried out the first experiment. He dropped a number of balls from a height of 27 ft., and found that they fell towards the south-east. This result, however, though accordant with theory, cannot be depended upon, since the theoretical deviation for this height is only about a fiftieth part of an inch.

Guglielmini, 113 years later, next tried the experiment in the tower Degli Asinelli at Bologna. The fall was about 300 ft.; but he found that his experiments were interfered with during the daytime by the vibrations of the tower. He therefore worked at night, and only when the air was perfectly calm. The suspended balls were examined with a microscope until it was found that all oscillation had ceased; then they were liberated by burning the thread which held them. They fell on a cake of wax. So truly were the experiments conducted that the greatest deviation between the holes made by the balls did not exceed half a line. Guglielmini then had to determine where the true vertical would fall, and for this purpose he dropped a plumb-line in August, 1791. Some idea of the difficulty of the problem and of the delicacy of the operations necessary to secure success, will be suggested by the fact that he had to wait half a year before his plumb-line came to perfect rest. He found, then, that the deviation of the balls he had dropped (16 in all) was 7·4 lines towards the east, and 5·27 towards the south.

The mathematicians set to work to inquire whether this result accorded with theory. They found the deviation should have been but about five lines towards the east, and none towards the south. On inquiry it was found that the difference might fairly enough be ascribed to two circumstances—first, the fact that the walls of the tower were perforated in different places, and the air consequently disturbed by currents; secondly, the fact that whereas the balls were dropped in the summer, the plumb-line was let fall in the winter, and the tower would doubtless be affected by the difference of temperature.

But while these considerations explained the observed discrepancy, they rendered the experiments valueless. If scientific men were like the paradoxists they would have stuck to it through thick and thin that the experiments proved their position; but, fortunately for the interests of truth, scientific men are more modest, more truthful, and more patient. They quietly abandoned the experiments as practically a failure, and forthwith instituted new trials with new precautions and new contrivances to render the results more trustworthy.

The successful experiments finally conducted on Newton's method are full of interest and instruction.

(To be continued.)

On Saturday last, Mr. J. H. Adams, riding a 46-in. "Facile" bicycle, accomplished the astonishing distance of 266¼ miles within the twenty-four hours, thus beating all previous records. The route was from Devizes, *viâ* Marlborough, Hungerford, Slough, Rickmansworth, and St. Albans, to Biggleswade, and returning by same route as far as Hungerford, thence to Swindon and back, and completing the time on the London road. This performance has caused considerable excitement in cycling circles. On the same day Mr. E. Oxborrow, also riding a "Facile," accomplished 234 miles over the same route.

BRITISH SEASIDE RESORTS.

FROM AN UNCONVENTIONAL POINT OF VIEW.

By Percy Russell.

(Continued from p. 216.)

GREAT as is the interest attaching to Peel and Douglas, Castletown, known in Manx as *Balley Cashtal*, or the town of the Castle, far exceeds them both in its historic and antiquarian associations. It stands on the margin of a bay of the same name, and clusters about Castle Rushen, originally a Danish fortress of extraordinary strength. Some of the almost Cyclopean walls of this famous fastness of the Danish times are six yards thick. They are constructed of very hard limestone, and such is the almost imperishable character of the masonry that the marks of the mason's chisels still remain in many cases distinctly visible, although the work is not much less than a thousand years old. The castle was originally founded by Guthred II., and has been added to during succeeding epochs, so that it is in some measure a visible and most instructive record of British castle architecture. Robert Bruce once besieged the castle for six months, in or about 1313. On the shore, not far from this fortress, is a mound surmounted by the remains of what was once the place of execution in this ancient seat of Manx Government, and here William Christian, who makes so striking a figure in Walter Scott's "Peveril of the Peak," was put to death by order of Lord Derby for surrendering Castle Rushen to the Parliament. The history of the Isle of Man carries us far back in its early authentic phases to a line of wild Welsh Kings, who reigned from the sixth century for several generations. A line of Norse Kings succeeded, until the Manxmen, weary of their rulers, appealed for protection to Edward I., and, by a formal document, submitted the island to the British Crown, retaining, however, all their local laws and customs. The government of the island was eventually granted in perpetuity to the House of Stanley, and the Earls of Derby were long Lords of Man. Eventually, by marriage, the island descended to the Athol family, and in 1806 the sovereignty was bought of the Duke of Athol by the British Government, and some privileges he still retained were subsequently sold for a large sum. Once on a time, the Isle of Man was undoubtedly a great Druid station, and this is attested by numerous archæological remains. The Isle of Man now forms a separate Bishopric, believed to be as old as the year 447 A.D. The island, as is popularly known, has its own constitution, laws, and courts; and the House of Keys, self-elective until 1866, is one of the most curious legislative bodies in Europe.

Few parts of the British Isles thus far north possess so fine and equable a climate. This is the result, no doubt, of the position occupied, sheltered at once by Irish, Scotch, English, and Welsh mountains; but the wild, rocky shores are scourged by terrible tempests at times.

Myrtles, Portugal laurel, the arbutus, and other plants usually associated with a very much warmer latitude thrive well, and in an orchard at Castletown a single apple-tree yielded in one season 16,000 excellent apples. In the winter, however, there are heavy snowstorms, and the pastoral interest suffers severely at times. Some beautiful larch-trees have been planted in places, but the sea gales are very unfavourable to their growth. The oak thrives well, and one lovely glen conducting from Douglas to the interior should be visited by every tourist who has a soul for sylvan beauty. This place is known as Glen Darrah.

In the northern districts wheat is raised, and oats and barley are freely grown. Flax is raised, too, and wrought up by many of the cottagers, both for home use and for export. A race of very hardy ponies is peculiar to the island, and partridges and hares abound, as do also woodcocks and snipe. In olden days falconry was much practised, and, indeed, the falcons of Man were much celebrated. It has been frequently remarked that no poisonous creature is found, but this, I fancy, is rather apocryphal. Red deer once roamed over the mountains, and the skeleton of the elk has been found in quarries. The land-tenure system is worth studying, especially in these days, when the English landlords are on their trial. "We do not hold farms," a Manxman will remark, "as is done in England; there they pay for them and return them to the proprietor; ours are our own, and we bequeath the whole." There are, however, numerous exceptions; and, indeed, for so small a community, there is ample variety in the existing modes of land-tenure. The selling of the island to England by the Duke of Athol was a most unpopular proceeding, and a current rhyme among the people declares that:—

> The babes unborn will rue the day
> That the Isle of Man was sold away.

Formerly the British Navy was largely recruited from among the islanders, and Manxmen were and are held in high esteem by British naval officers. One man, pressed out of Douglas, rose to be first lieutenant to Nelson in the *Victory* at Trafalgar. There are a good many native domestic manufactures and industries worthy of notice, but the fisheries employ a large number of the inhabitants, and the departure of the great herring fleet is a sight that once seen is not easily forgotten. The people are healthy and, as a rule, long-lived, and as a body are superstitious to a degree. They are a religious people, as may be inferred, and it is to their credit that the Manx language does not include any words at all equivalent to those oaths which, unfortunately, abound in our Anglo-Saxon. I don't know how this may be just now, but not many years ago, when an ill-advised emissary of some Infidel propaganda landed in the island to distribute tracts, a sensation was produced among the people as though a man-eating tiger had made its appearance, and yet I must confess that with all this the Manxmen are rather addicted to drunkenness. They are, like most Celts, fond of music, and pay great respect to their various ancient remains, their circles and crosses, and other legendary monuments One trait strikes a stranger much, and that is the singular fondness of the people for law. Formerly, love of litigation was so great that persons are said to have gone for redress in the courts of law for sums amounting to only one shilling, which, by the way, used to be the ordinary day's earnings of an industrious Manxman. As is the case with their Celtic cousins in Ireland, indolence is a characteristic of these simple and generally amiable islanders, and most of the workmen observe the custom of taking not one but two hours as an interval of rest in the middle of the day. Like the Irish, the Manxmen are hospitable, but to English notions this hospitality goes rather far, since even the passing beggar, on presenting himself at the door of a house and asking for board and bed, could not be denied his "simple boon," and at one time the plague of sturdy beggars was a serious evil.

The Manxmen have really no literature, except some very melancholy songs in the style of Ossian, and, like most Erse poetry, indicating consciousness of vanished national power. The first book ever printed in Manx was issued by Bishop Wilson as late, comparatively speaking, as 1699. Subsequently, village libraries were formed, and real progress made in removing the reproach of illiteracy from this corner of the British Islands.

One of the best views in all the island is from Ramsay Bay, in the north. The coast at this point forms a fine semi-circular sweep, flanked by the huge precipices of Maughold Head and by a range of red cliffs. Right in front is the fine and lofty Mull of Galloway, with its grey cliffs and storm-worn aspect. The innumerable sea-fowl, too, which breed among the cliffs of the island, give a very striking character to the coast, and assimilate them greatly to some of the western islands of Scotland. Taken all in all, for persons seeking entire freshness of scenery, combined with great natural beauty, and desirous of combining studies of primitive rural British life with seaside recreation, the Isle of Man forms an excellent resort, and its historic and archæological reminiscences and remains abound in permanent national interest. It now remains to deal in detail with the very extensive coast line of Scotland, which, as I shall show in my next, possesses some very extraordinary and deeply interesting features.

THE INTERNATIONAL HEALTH EXHIBITION.

XX.—ANTISEPTICS AND DISINFECTANTS.

As preliminary to an inquiry into the present aspect of the sewage question, the pollution of rivers, and the utilisation of house refuse, we propose to give a brief review of the principal methods which have been introduced for the purpose of securing those conditions which are so important to the maintenance of healthy homes, where the accumulation of waste products, and their outcome of filth, cannot conveniently be avoided. To check the spread of disease arising from dirt, and the consequent growth and multiplication of evil germs, is the work of the purely antiseptic re-agent. But there are many drawbacks to the exhibition of such preparations as carbolic acid, tar, turpentine, &c., the chief of which lie in their deleterious effects upon the vitality of living things, and their own offensive odours. Their mode of application, too, in the form of powders or soaps for *general* use is, to say the least, far from desirable; for, in the former instance, the accumulation of dust is aggravated, and, in the latter case, they cannot be employed with any degree of convenience and comfort. Powders and soaps, however, are both of great value in *special* instances, and we are delighted to find that the new Carbolic Sanitary Company, of Hackney Downs railway-station, have produced a carbolic powder under the name of "The Government Disinfectant," which is a combination of various agents, carbolic acid predominating, and which acts as a deodoriser in addition to its other antiseptic and disinfecting properties.

To fulfil the requirements of a good disinfector, the material employed ought to be odourless, free from staining propensities, non-poisonous to man and the higher animals, non-corrosive, and capable of being both generally and specially applied with the greatest degree of convenience and a minimum of expense. There are many such preparations now in the market, amongst which the more notable may be viewed and tested in the Eastern Annexe of the Exhibition.

"Condy's Fluid" claims our prior attention as having been the pioneer of this class of disinfectants. It is prepared from the permanganate of potash, and acts as a powerful oxidiser of organic matter. The varied uses to which it can be applied may be gathered from a little

pamphlet issued by the Company,* in which a large amount of useful information is incorporated. There are two qualities of the Fluid—one crimson and the other green; both have the same properties, but differ in degree of strength, the crimson being the more potent of the two, and better adapted for general domestic purposes than the green.

A preparation called "Hartin's Crimson Salt" deserves special mention here because it fulfils, in their integrity, all the requirements of a good disinfector, which we have noted above. As its name implies, it is prepared in form of a readily soluble salt, a shilling bottle of which will make 300 gallons of crimson fluid of a strength sufficient to supply the wants of any ordinary case where disinfection may be necessary. It thus comes within the easy reach of even the poorest householder, and we therefore strongly recommend it to the notice of those who are desirous of promoting really valuable sanitary measures.

"McDougall's patent Carbolic and Sulphurous Disinfectants, in Powder, Fluid, and Soap; or, in other words, the most potent Antiseptic with the best Disinfectant," is the title of a descriptive and illustrated price-list issued by Messrs. McDougall Bros., of 10, Mark-lane, in which a large variety of excellent preparations, each adapted to some special want, is given. Amongst other things, we may draw attention to the "Fluid Carbolate,"—a combination of carbolic and sulphurous acids in the strength of 1 per cent. each, which is an antiseptic of value for healing purposes, being applicable both externally and internally. It is a neutral solution of carbolate of lime and sulphite of magnesia, and combines all the valuable qualities of both carbolic and sulphurous acids without any of their objectionable properties. We shall have occasion to notice these exhibits once more in connection with improved appliances for disinfection, fumigation, &c.

The old-fashioned plan of burning sulphur and charcoal in the fumigation of infected dwellings has not been abandoned. It is, indeed, a most effective method of operation; its only drawback lies in the fact that it is inconvenient. We are glad to find, however, that this really useful process bids fair to be revived in the compact sulphur disinfectant cakes brought into use by Mr. Charles Gander, Sanitary Inspector of Alcester, and now being exhibited by Mr. Overbury. One of the cakes can be carried by the sanitary inspector in his pocket, and lighted in the house after the patient has recovered sufficiently. It is estimated that the fumigation of one house would by this means cost about 6d., so that we consider it to be, from every point of view, a decided advantage over all former methods.

Under the fanciful name of "Affinitan," an excellent disinfectant, manufactured by Mr. A. J. Shilton, F.C.S., of 40, Paradise-street, Birmingham, is now being exhibited. The inventor claims that it "is entirely free from smell, and does not stain. All foul odours are instantly destroyed by it, and as a means of preventing the spread of disease it is unrivalled." Its cost brings it within the reach of all.

Anti-Microbe† is another valuable disinfectant. It is said to act as much on ammoniacal and sulphuretted hydrogen gases, as on organic matters which are subject to decomposition, and this it does without any disagreeable odour. These combined with its non-poisonous properties, place it in the foremost rank of modern disinfectants.

A novel device is the Austin Porous Disinfector,‡ of which the following quotation will give a sufficiently explicit outline:—

"They require no fixing, as they can either be suspended or placed at the bottom of the cistern. There are no mechanical parts whatever in them, as the disinfector consists merely of a box of a porous material, through which the disinfectant passes after the crystals are dissolved by the action of the water. They will deodorise the water in the w.c.'s drains for fourteen months, and prevent zymotic diseases. The crystal disinfectant contained therein is inodorous, non-poisonous, and non-corrosive." We consider that every household ought to be provided with one of these useful disinfectors.

* "The Book of Directions for the Use of Condy's Fluid." Condy & Mitchell (Limited), 67 and 68, Turnmill-street, E.C.

† To be obtained from J. R. Meihe, 15, Abchurch-lane, London, E.C.

‡ Called after its inventor, Mr. Austin, 61, Wool Exchange, Coleman-street, London, E.C.

VACCINATION FOR YELLOW FEVER.

DR. FREIRE, of Rio Janeiro, in a recent letter to the *Sanitary News*, writes as follows:—

In compliance with your request, I will give you an account of the chief points of interest connected with my studies on yellow fever. I can, of course, give you only a very brief summary, and for further information may refer you to my two memoirs—"The Cause, Nature, and Treatment of Yellow Fever" and "The Contagion of Yellow Fever." An extended report on all the theoretical and practical bearings of my researches is now in press, and a copy will be sent to you as soon as issued.

The method of culture which I have followed is Pasteur's. I withdraw blood, or any other organic liquid, from persons sick with yellow fever, or from the bodies of the dead, using the most scrupulous precautious, and introduce these liquids into Pasteur's flasks, previously sterilised, and containing a solution of gelatine or beef "bouillon." In these conditions the microbe develops abundantly, and becomes of itself attenuated by the action of the air, which filters through the tampion or amianthus with which the flask is corked. The purity of these cultures is demonstrated by microscopic examinations, of which you will find a good illustration in my memoir, "Experimental Studies on the Contagion of Yellow Fever."

The microbe appears in the form of little black points, like grains of sand (780 diameters); in the mature form it presents the appearance of round cells with an ash-grey or black rim, containing in their interior yellow and black pigment and some granulations which will be the future spores. These cells burst at a given moment, and pour out their contents, *i.e.*, the spores, the pigments, and a nitrogenous substance composed of ptomaines, which I have isolated not only from vomited matter, but also from the blood itself, and from the urine. The yellow pigment, being very soluble, produces the icteric infiltration of all the tissues by a sort of tinctorial imbibition which may go on even after death; the black pigment, as well as the detritus, resulting from the rupture of the cells, being insoluble, is carried into the general circulation, and produces obstructions in the sanguine capillaries, whence the apopleptic symptoms so common in yellow fever and in the urinary tubules, whence the suppression of the urine, a very frequent and terrible symptom in this disease.

I have described this microscopic organism under the name of *Cryptococcus xanthogenicus;* its development resembling that of this genus of algæ.

After having demonstrated the contagious nature of yellow fever by experiments upon barndoor fowls (see my memoir), I made experiments in preventive inoculations, first upon animals and afterward upon men; I did not fear to do this, because a multitude of experiments upon animals

had previously convinced me of the perfect safety of inoculation with attenuated cultures.

Up to this date I have vaccinated 450 persons, for the most part foreigners recently arrived. Freedom from yellow fever has been pronounced among those thus vaccinated, for they have passed through a quite severe epidemic, and only six deaths have occurred among the 450 vaccinated persons —that is to say, less than two in a hundred—while more than a thousand deaths have occurred among the non-vaccinated, the mortality of the non-vaccinated sick being about thirty to forty per hundred. Thus, if we take one hundred vaccinated persons, under the most favourable conditions as regards receptivity, we have only two deaths during the entire epidemic; if we take one hundred non-vaccinated sick, we have thirty to forty decedents, which gives a mortality fifteen times greater among the non-vaccinated. Even if the mortality were only ten times or five times less great among the vaccinated, the preventive measure would be worthy of adoption. The protective inoculation for charbon gives an immunity to one-tenth, and that of vaccination for small-pox guarantees an immunity to one-fifth, according to the calculations of Bousquet.

Dr. Domingos Freire,

Professor in the Faculty of Medicine of Rio Janeiro,
President of the Central Junta of Public Hygiene.

"ENGLISH AS SHE IS SPOKE" IN AMERICA.

By Richard A. Proctor.

MANY Americans believe that English is only spoken in its purity under the Stars and Stripes. Possessed by the notion that every English-born person systematically drops his h's where they are wanted, and inserts them where they ought not to be, the American is apt to regard the peculiarity as typical of the differance between English English and American English. If this view were sound, it would be interesting for Englishmen to inquire how the language which, after all, is theirs, is spoken beyond the Atlantic. There is work for a new grammarian in this direction. For, if Americans, as a whole, are more careful than Englishmen about their aspirates, they assuredly have some very original notions about other matters not less important. Thus in the new grammar, if based on the language of the immense majority of Americans, especially out West, we should find the following new form of the imperfect tense of "To be":—

I was, he was, we was, you was, they was.

We should, furthermore, have rules justifying the expression, "There aynt no." The past tense of "do" and "come" would be found to be "done" and "come" in this new grammar—*as*, "I know he done it," "we knew you'd do it when you come along." The new language would have no verb "to lie," except as signifying "to tell a lie"; so that "let it lay there" would replace our bad English "let it lie there"; with many other changes of an equally original nature.

Whether, with the further progress of time, still stranger changes would not have to be made may be reasonably asked. For much of the atrocious grammar used in America has arisen from the habit of imitating negro talk. And already you hear white folk say, not "he did it," as we benighted Englishmen do, nor "he done it," as the more grammatical Americans still try to say, but "he gone done it," and so forth.

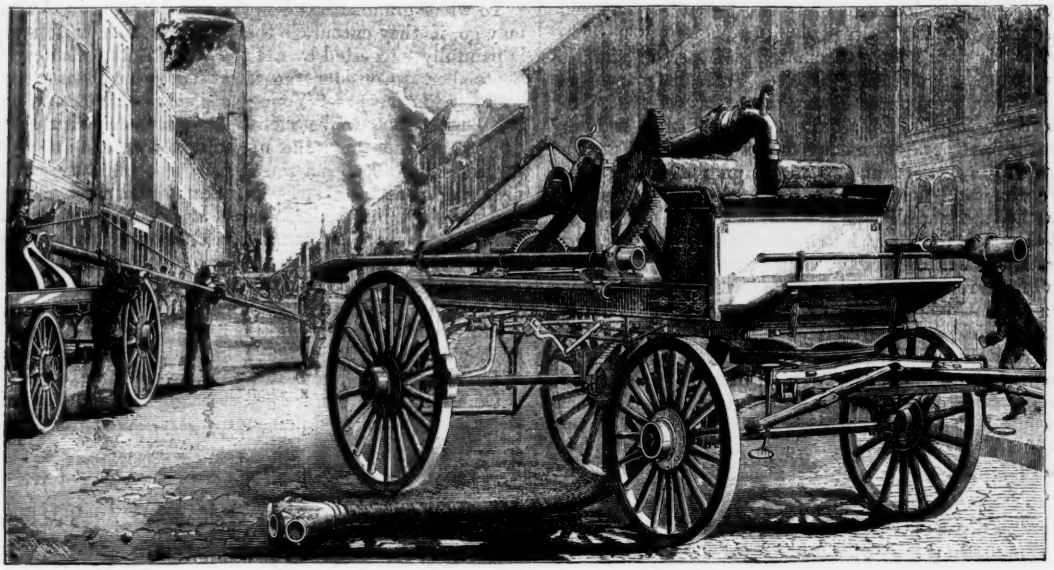
To what grammatical lengths our kinsmen in America may go, if they encourage their present taste for novelty, is painfully suggested by a little story in the *Century* for September. Consider the following speech (made by a well-to-do farmer):—"Young people, 'special females, owes it to theirselves to be monst'ous, streemous keerful and particklar who they take up with in that kind o' style" (he is talking about marriage), and "special in the pints o' prop'ty. For it's a heap easier, and it's a heap convenanter, and it's a heap comfortabler to *start* with some prop'ty than it is to work an' projeck, and deny a body's self the lugjieries, an' the comforts, an' sometimes the very needcessities of life, which, in course, a person'd like to have 'em, but which, when they start po'" (nigger English or American for poor) "they has to wait for 'em, an' which, ef they'd wait an' look around keerful, the chances is some of 'em might do better than what they been a expectin'."

On the whole, I prefer English English to nigger English, but this may be a weakness on my part.—*Newcastle Weekly Chronicle.*

THE NEW YORK FIRE DEPARTMENT.

ALTHOUGH the single swing of a pendulum only measures a second of time, yet each one of these periods may be so intimately and directly connected with events of such vital interest as to become of the greatest importance. It is doubtful if there be any moment, in any calling, in which so many movements bearing immediately upon the result are crowded as in the fire department when an alarm is received. The ease with which an incipient fire can be extinguished, and the fearful rapidity with which it spreads and gets beyond control, compelled the adoption of every device and method that would in any way lessen the time intervening between the alarm and the arrival at the fire. Consequently, each fraction of a second is carefully guarded lest it escape before having seen the performance of some step tending toward the accomplishment of the main object. The seeming confusion, the apparent mixing up of men, horses, and machinery, is the outcome of persistent study aided by a thorough acquaintance with the wants, and with even the minutest detail that could be made subvervient.

All the fire-alarm boxes in this city are connected by wires with the headquarters of the fire department, and are all numbered. When the hook in a box is turned down, the alarm is made only at the headquarters, where the operator, by the aid of a switch-board, instantly sends the number of that particular box to every fire company in the city. In each company's house, near the door, are placed the gongs, recording apparatus, telephone, &c. (The position of the various instruments, the location of the engine and stalls, and of the poles by which the men descend from the upper floors, and the method of hanging the harness so that it may be placed upon the horses in less than a second, are all plainly shown in in our view of the interior of the quarters of Engine Company 33, on Great Jones-street.) The first alarm is sounded upon a small gong, familiarly known as the joker, and the first stroke sets in motion a train of mechanical movements which, though in operation but an instant, produce most strange results, and change a scene of quiet into one of startling activity and of absorbing interest to the stranger who chances to be present. The first impulse of electricity passing over the wires attracts the armature of a magnet, which releases a small weight sliding on a rod placed beside the gong. This weight strikes the arm of a lever that permits the fall of a heavy weight



The Water Tower.

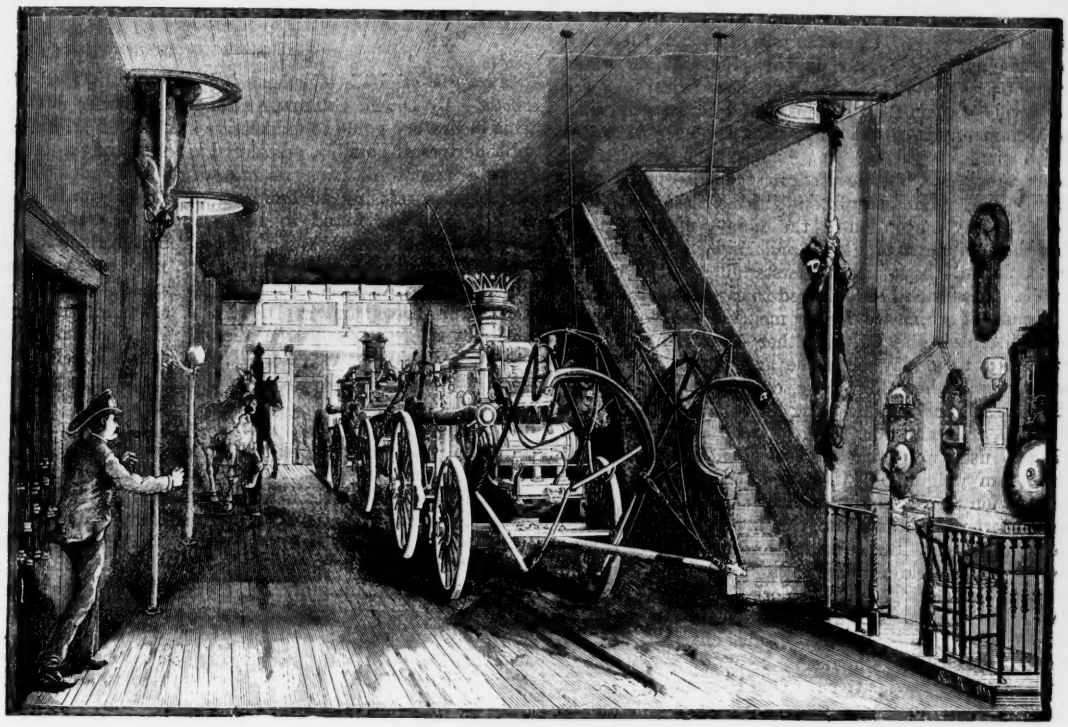
located below the floor, and which is so connected as to withdraw the bolts holding the halters of the horses, who dash forward to their places under the harness. The same impulse of electricity has sounded the alarm upon gongs in the sleeping apartment on the second-floor and in the reading-rooms on the third-floor, and the men come sliding down the brass rods. The time of receiving the alarm is recorded by a small clock that is stopped at the first stroke. Before the gong has ceased ringing the harness has been dropped and clasped, the driver is belted to his seat, and the men are waiting for the doors to be rolled back.

So far each company in the department has gone through these operations, since all are compelled to hook up at every alarm. The boiler of the engine is directly connected with a coil of pipe in an ordinary egg-shaped stove placed in the basement. Low down upon the rear of the engine are two pipes which are attached by telescope joints to two pipes leading up from the coil. When the engine is to go out, two valves which prevent the escape of water from the boiler are closed by moving a lever, and a rod pressed down through a hole in the floor. This rod operates four valves; two which close the pipes leading through the floor, and two which open pipes leading to a small tank in the ceiling, in order that the coil may be supplied with water during the absence of the engine. The rod also raises the lid of the stove to deaden the fire.

The strokes upon the joker might be compared to a series of dots and dashes sounded quickly—thus, two strokes and a pause, three strokes and a pause, and five strokes would indicate that the alarm came from box numbered 235. These strokes are repeated two or three times by the joker, and are then told off, but much more deliberately, upon the large gong. This arrangement is to save time, and while the men are hitching up they are counting the strokes, and if there is any doubt about the number they wait until the signal is given by the big gong. But it generally happens that the engine is on its way to the fire before the second gong has begun its work. After the exact number has been ascertained, all those companies which are expected to respond to that number start for the scene of the fire, while the other companies, after waiting a short time, unhook the horses and place the apparatus in the condition it was before the alarm was struck. We thus see that one stroke places the entire force of the department on the alert, and fifty-four engine companies (nine of which are double companies, and are provided with an extra engine and a large number of men), seventeen hook and ladder companies, and the two water towers are ready to turn out at every alarm. Many of the companies are frequently out of their houses in three, four, or five seconds, and at the last horse show in Madison Square Garden, this city, Engine Company 33 hitched up once in $1\frac{3}{4}$ sec., once in $1\frac{5}{8}$ sec, and once in $1\frac{3}{4}$ sec.—or three consecutive times in less than two seconds.

The most important item in the time question is getting the horses in harness. The horses are placed in stalls as near the pole as practicable, and are kept bridled. The harness is attached to the engine, and is raised to such a height that the horse has no difficulty in passing to his place beneath it. It is suspended from a Y-shaped frame of tubing, at each end of which is pivoted a downwardly-curved hook, upon which the harness rests. The reins pass through a catch in the centre of the frame, so that by pulling them the hooks are released and the harness allowed to fall upon the backs of the horses. The collars are hinged at the middle, and one free end is provided with a bolt which enters a socket in the other end, in which it is held by a spring catch. The hinge is made wide so as to prevent lateral movement and insure the entrance of the bolt when the ends are brought together.

The forward fire-engine shown in the illustration is from the Clapp & Jones works, and is what is known as second class. The plunger is $4\frac{7}{8}$ in. in diameter, and the engines (double) are 8 by 7 in. The boiler is 64 in. high, 35 in. in diameter, has 120 drop water pipe tubes, and 40 smoke flues. It is capable of throwing three streams, two side ones $2\frac{1}{2}$ in., and a centre one $3\frac{1}{4}$ in. in diameter. It is not necessary to notify the engineer of the amount of water required, since the quantity can be controlled by the man in charge of the nozzle. In the nozzle is a conical shaped plug that can be moved longitudinally by turning a screw collar, and by this means a stream can be obtained



Interior View of a Model Fire-Engine House.

varying from the size of a pin to the full capacity of the pipe. In case the nozzle is reduced or is completely shut off, the engine is relieved of all liability to serious strain by the action of an automatic relief valve designed by Mr. Pallet, of Engine 24. This valve is placed beside the pump, to which it is connected at two points, one above and the other below the plunger. The connecting passage is interrupted by a valve held upon its seat by a spring in such a way that the pressure necessary to raise the valve can be regulated at will. When the full power of the engine is required, the valve is screwed down; but, for ordinary work, it is set at about 80 lb. As soon as the water pressure in the pipes is increased beyond this point, by partially closing the nozzle, the valve is lifted, and communication made between the top and bottom of the pump-chamber; when the nozzle is completely closed, the valve is raised clear of the passage, and the pump churns the water round and round. The engineer is relieved of all care, and the control of the water is placed in charge of the one who best knows the quantity required. The spray nozzle consists of a cylinder, one portion of which is thickly studded with small holes, and upon which slides a collar wide enough to cover the perforated section when a spray is not desired.

The sleeping quarters of the officers and men are on the second floor. Through the floor, in locations so as to be most quickly used, are three openings, in the centre of each of which is a smooth brass rod leading to the floor below. Upon the third floor are the billiard-room, lockers, drying-room, which has a zinc floor, and, together with the bath-room, is heated by a furnace in the basement, and feed-room. Hay and grain are raised from the rear. The grain bins are connected with the lower floor by tubes, and the hay is passed down through chutes, so all the dust is confined to one small room.

When fighting a fire, it sometimes becomes essential to throw a powerful stream into the upper stories of a building, and to give the most satisfactory results the nozzle should be elevated and brought in close proximity to the window. This is accomplished by the water tower (shown in several positions in the first view), which consists of a large pipe so mounted upon trunnions that it can be quickly raised to a vertical position. The lower end of this pipe is connected by a flexible pipe that extends under and to the rear of the trunk, where it terminates in four 3-in. inlets, each of which may be coupled to a hose leading from an engine. Each inlet is furnished with a swinging valve, operated by the pressure of water in the pipe. Various lengths of pipe can be screwed upon the upper end of the trunnion pipe, giving the following lengths: single, 29 ft.; long single, 36 ft.; two short lengths, 43 ft.; two long, 50 ft. Between the end of the pipe and the end of the nozzle is inserted a short piece of flexible pipe that moves between two side flanges. Projecting from each side of the nozzle is a stud that enters a groove in the flange. The nozzle is connected by a light wire rope with a small drum placed on the body of the truck, from which location all the movements of the tower are guided. By winding up this rope the nozzle will be depressed, and will deliver water in a downward direction. The short connecting-pipe bends upon a curved frame that prevents wrinkling. The elasticity of the pipe and the force of the water are sufficient to raise the pipe when the rope is unwound. To stay a long length of pipe there is a stout wire rope extending from the top to a drum at the base. This rope is extended by braces hinged to the lengths. The vertical pipe may be moved upon its own axis. The stream may be delivered at any height below a certain limit, and directed up or down or to either side.

A distributor to be attached to the end of a hose con-

sists of two curved hollow arms, one at each side of the closed end of the pipe. Upon the hub of each of these is a pinion engaging with a gear on the pipe. When water under great pressure is sent through these arms, they are rapidly revolved upon their own axes and at the same time about a common axis, so that they send a shower of water in all directions.

Water tower No. 2 is located in the same house with Hook and Ladder Company 3, on Thirteenth-street. Few people have any conception of the number of implements forming the equipment of a hook and ladder company, and fewer people still have any understanding of the uses of these tools. The truck here referred to carries the following tools, the use of which we briefly mention:—Two Bangor extension ladders, one 65, the other 45 ft. long, so constructed that they may be made any length up to the extreme; two ladders 35 ft. long, one 33 ft. long, one 25, one 20, one 15, one 12, one hook 20 ft. long, one 15, one 12, two 10, and six 6 ft. long. Two Babcock fire extinguishers, used upon small fires when required. One battering ram weighing 64½ lb., and formed with a thick wooden section terminating in an iron shoe at one end, and having a short rod at the other; this is manned by six men; its use is apparent. Six tubular hand-lamps, four rubber buckets, seven forcible entrance tools. The iron shutters and doors upon the buildings of New York, being secured upon the inside, are most serious obstacles placed in the way of firemen, who, in order to effect a quick entrance, are supplied with crowbars and jimmies made of the best steel and after the most approved pattern. One 10-pound steel maul. Four cotton hooks, four hay forks, and two shovels for the removal of loose material. Four axes for cutting through floors, roofs, and partitions, and two picks for entering walls. One crow-bar, ten wrenches and belts, including a gas-pipe wrench for shutting off the gas when necessary; one roof rope 125 ft. long; two horse blankets; one whip. One respirator, by which the wearer is enabled to enter dense smoke and to encounter noxious vapours. One distributor, described above. One four-way connection. One length 3½-in. combination hose. One copper pipe 3½ in. Three nozzles. One iron pipe holder. One calcium light, with oxygen and hydrogen tanks and fittings. This is found most useful in lighting up the scene of operations. Two danger flags, to signal trains upon the elevated railroads, one patent horse-shoe, one butting-stick, one brass gong, two cushions. One cellar pipe, 1⅜-in. nozzle, which is used to direct a stream to any part of a cellar, up or down, when thrust through a lower window, and which is of the utmost advantage in situations where the ordinary nozzle could only be made to deliver a downward stream. One cross bar and chain. Three scaling-ladders of the following lengths and weights: 16 ft., 35 lb.; 18 ft., 39 lb.; and 14 ft., 27 lb. These are wooden poles backed with a strip of iron, and having steps at about every fourteen inches. To the upper end is secured a right-angled arm, which is notched upon the under side, and which ends in an angle piece. The hooks so formed are long enough to extend to the inner side of the widest window-sills. The ladder is raised and the hook thrust through the window when the fireman ascends. Another ladder may be handed to him and by him hooked in the second window, and another in the third window, until a string of ladders reaches the roof, or he may support himself upon the sill, raise the ladder he came up by to the second window, and so on to the roof. One life-line, 150 ft. long, and three coils of life-saving rope. The total weight of the tools is 2,718 lb., and these, together with the twelve men who go with the truck, and the truck itself, weigh 9,756 lb.—*Scientific American.*

Reviews.

Analysis of Milk, Condensed Milk, and Infants' Milk Foods. By Dr. N. Gerber. (London: Trübner & Co.)—This laboratory guide to exhaustive analysis of all kinds of milk derives, if possible, additional interest and importance from a recent decision of one of the London Police Magistrates, refusing to fine the vendor of tinned Swiss milk which was found to be deficient in cream. Dr. Gerber's book furnishes the most explicit instructions for the testing and analysis, chemically, microscopically, and physically, of every kind of milk—human, animal, condensed, preserved, and in the form of so-called milk-foods; treats of milk as the cause of disease; of Government control over its supply, &c., &c. This is a book which should be in the hands of every analyst and sanitary inspector in the kingdom.

The Safe Use of Steam. By An Engineer. Fifth Edition. (London: Crosby, Lockwood, & Co. 1884.)—The ignorance exhibited by a far too great proportion of those in charge of steam-boilers is something awful; and that what the author of this most excellent and practical little work before us rightly speaks of as "the appalling results" of steam-boiler explosions are not even more frequent than they unhappily are, may well excite the wonder of all who have ever seen how those belonging to thrashing-machines and traction-engines in agricultural districts are attended to. With the very plain and explicit directions contained in this small pamphlet, once mastered, a boiler accident ought to be, humanly speaking, impossible.

Comic Readings, English and American. (London: W. Kent & Co.)—Performers at "Penny Readings" (a form of entertainment still surviving in some agricultural districts) will find suitable subjects for their elocutionary efforts in this little volume.

Architecture and Public Buildings. Their relation to School, Academy, and State in Paris and London. By William H. White. (London: P. S. King & Son.)—Among the things which "they manage better in France" the author of the work before us would give a very prominent place to the supervision of the erection of public buildings. He attributes the artistic superiority of Paris to the existence of the Academy and of the School of the Fine Arts there, and to the fact that a State hierarchy of direction and control, consisting mainly of architects of position, has the virtual superintendence of every public building and monument in the French metropolis. He is very severe upon our own Royal Academy for its dereliction of duty in the matter of architecture, and essays to prove how dismally our Department of Public Works and Buildings breaks down in the absence of competent, disinterested, professional architectural advice. He endeavours to show that were the Government only to appoint a species of consultative council, to be drawn (although Mr. White rather implies than asserts this) from the Royal Institute of British Architects, public buildings would be erected better, more economically, and, above all, much more beautifully and artistically than they are under the present system. He tries to discuss his theme more or less judicially, and to keep his personal proclivities in the background, but here and there they peep out, as in his ill-disguised expression of contempt for the Gothic revival. On the whole, though, his book is worth reading by all who are concerned for the beauty and utility of our Government buildings, and his *exposé* of the utterly irresponsible character of the supervision supposed to be exercised over their erection may well be laid to heart by the British taxpayer.

PRACTICAL DIETETICS.

[COMMUNICATED.]

SOME time ago I promised some tables, the result of practical experiment, as opposed to the theory of foods. The following tables are taken from the XXVI volume of the Journal of the Statistical Society, article "Dr. Guy on Dietaries."

"A series of eight experiments were made, consisting of six (the first three and last three) on groups of ten prisoners variously constituted of men and women at different ages, and of boys and girls about 13 or 14 years of age; and of two larger groups of 21 and 20 respectively, of which the greater number were adult males. The particulars of the eight dietaries, with the average weights of the prisoners at the end of the month (each dietary being continued for that period) are given in the table annexed:—

EXPERIMENTS AT GLASGOW BRIDEWELL 1840.

	Per week.							
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.
	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.
Oatmeal	91	91	91	91	91	56	91	—
Potatoes, boiled	336	336	—	224	112	112	—	672
„ baked	—	—	336	—	—	112	56	—
Bread	—	—	—	—	—	—	—	—
Meat	—	—	—	28	56	—	—	—
Total solid food	427	427	427	343	259	280	147	672
	Pints.	Pints.	Pints.	Pints.	Pints.	Pints.	Pints.	Pints.
Buttermilk	10½	—	10½	10½	10½	7	10½	—
Skimmed Milk	—	2⅓	—	—	—	—	—	—
Broth*	—	—	—	—	—	—	14	—
Total liquid food	10½	2⅓	10½	10½	10½	7	24½	—
Average weight gained	4 lb.	4 lb.	—	—	—	2¾ lb.	—	3½ lb.
„ „ lost	—	—	1½ lb.	1¼ lb.	very slight loss	—	less than ½ lb.	—
Prisoners submitted to experiment	5 men 5 boys	5 men 5 girls	3 young men 5 „ women 2 boys	16 males 5 females	15 males 5 females	5 young men 5 „ women	5 young men 5 „ women	10 young men and boys.

* Containing to the quart 4 oz. of barley and 1 oz. of bone, with vegetables.

"Now, though the groups of prisoners are small and variously constituted, and the experiments consequently wanting in scientific exactness, some of the results are worth noting, as throwing light upon the value of these weighings as used as tests of a sufficient dietary. Between the first and third experiments, for instance, there is this difference only, that the potatoes are boiled in the one and baked in the other; but while the ten prisoners in the one experiment gain on an average 4 lb., the same number in the other experiment lose, on an average, 1½ lb.* Again, though the substitution in the second experiment of 1⅓ pints of skimmed milk of 10½ pints of buttermilk in the first leaves the average gain of 4 lb. unaltered, the restoration of the 10½ pints of buttermilk in the third experiment is followed by an average loss of 1½ lb., in lieu of an average gain of 4 lb. It is also worthy of remark that, while the four dietaries which are followed by a considerable average gain are all vegetable diets, and one of them consists of 6 lb. of potatoes daily, two out of four dietaries which show a loss of weight contain a liberal element of meat. Lastly, it may be observed that, while the eighth dietary, consisting wholly of potatoes, shows an average gain of 3½ lb., the seventh dietary, the only one from which the potato is wholly omitted, shows an average loss of less than half a pound." * * * * * * *

"Hitherto I have been dealing with mixed dietaries, several of which contain meat in some form or other, and the experiments at Pentonville were with dietaries of which meat formed a part; but I must now ask the attention of the society to dietaries from which meat has been wholly excluded, and to three dietaries especially which contain no animal food whatever. The first of these exclusively vegetable dietaries is very interesting, inasmuch as it is a prison diet on which prisoners were fed for long periods, and weighed at the beginning and end of their sentences. The history of this dietary and of its effects on the health of the prisoners and on their weight will be found in the Report of 1823 on the epidemic at Millbank. The facts are given on the authority of the Governor of the Devizes House of Correction. The dietary consisted of—

Bread	196 ounces per week.
Potatoes	112 „ „
Total solid food	308, and gruel 7 pints.

On two days in the week, a vegetable soup was substituted for the potatoes; but there was no meat whatever in this dietary, and no milk, or other animal matter. Nevertheless, the governor was able to report that this dietary agreed well with the prisoners, that no loss of strength was noticed, and that no prison could be more healthy. And he added, 'There is not now, nor has there been, any "case of scurvy."' It should also be observed that this exclusively vegetable diet, having been adopted in an English prison must have been strange to most of the inmates, who, before they became prisoners, had doubtless been able to procure more or less of animal food and of meat. The prisoners had been kept on this diet from various periods up to eighteen months—many of them for six months and more; 292 prisoners, in various groups, were weighed on entering and on leaving prison. Of thirty-eight prisoners thus weighed, after periods varying from two weeks to six months, twenty-seven were found to have gained, two to have lost, and nine to have neither gained nor lost. The average gain in weight was 3 lb. Two other prisoners, after eighteen months, had gained, on an average, 6 lb.; and twenty prisoners, confined for twelve months, had gained, at the end of that period, 5 lb., on the average. Four other groups of prisoners, confined during six months, three months, two months, and one month, respectively, gained, on an average, 3 lb., 3 lb., 2 lb., and 2 lb.

Here, then, we have in favour of a bread, potato, and gruel diet the most conclusive evidence. There was no loss of strength, an excellent state of health, no scurvy, and a most satisfactory addition to the weight of the prisoners. It should also be observed that there were among the prisoners several whose terms of imprisonment were sufficiently long to severely test any dietary.

Dr. Baly, in his paper in the *London Medical Gazette*, to which I have already had occasion to refer, gives an example of the same kind. It is that of the Stafford County Gaol, in which the weekly allowance of food consisted of:—

Bread	196 oz.
Potatoes	112 oz.
Total	308 oz.

with twenty-one pints of gruel, but no meat and no soup, and yet scurvy did not occur, its absence being verified by his own inspection of seventy prisoners confined in that gaol for periods of from three to six months.

In this case also a diet consisting wholly of vegetable food must have been new to the prisoners.

The third example of an exclusive vegetable diet is afforded by

* W. Mattieu Williams please make a note of.

the eighth series of Glasgow experiments. The ten prisoners were fed for one month on 6 lb. of potatoes per diem, and at the end of that period had increased in weight, one with another, no less than 3½ lb., or only ½ lb. less than the average gain in the first and second experiments of that series.

These are the only examples that I have happened to come across of a purely vegetable diet—a diet from which not merely meat, but every animal product, even milk, was excluded. But I have already, in this paper, given several examples of dietaries from which meat was wholly excluded, the only animal element being milk made into porridge with oatmeal, and into pudding with Indian meal. I ask your attention again to the exceptional dietaries, of which I am able to give you two notable examples. In the report on military prisons (1861) the diet for military prisoners in solitary confinement for periods less than 56 days is shown to consist of

Bread	56 oz.	per week.
Oatmeal	56	,,
Indian meal	42	,,
Total solid food	154 oz. with 10½ pints of milk.	

And the penal class diet of Millbank Prison comprises:—

Bread	84 oz.	per week.
Oatmeal	70	,,
Indian meal	70	,,
Potatoes	56	,,
Total solid food	280 oz. with 10½ pints of milk.	

The diet of military prisoners given above does not encounter objection on the part of the governors or medical officers whose views are stated in the report, and it may, therefore, be assumed to be sufficient for the support of robust men in confinement for periods less than fifty-six days; and this view receives strong confirmation from a passage in Dr. Tufnell's report from Dublin. He says:—"To the increase in the dietary, and especially its alteration, I have ever been, upon principle, opposed, because I found that I could, upon the old scale of dietary, maintain the men in the most perfect condition." Of the sufficiency of the more liberal penal class diet of Millbank, not merely for prisoners undergoing short terms of imprisonment, but for those who are in close confinement and under punishment for many months together, I am able to furnish the most convincing proofs. This dietary was favourably reported upon by my predecessor, Dr. Baly, in 1858, and in my own report for 1859. It has stood the test both of experimental weighings and more general observation of the state of health of the prisoners; and I have recently had occasion to report cases of men whose health has been maintained on this diet for seven, nine, eleven, fourteen, seventeen, and eighteen months. The women who are on this diet are weighed every month, and the results are quite satisfactory.

I have no hesitation, then, in expressing an opinion in favour of the sufficiency of a dietary from which the meat element is wholly excluded. I have no doubt that health may be preserved, and with it capacity for labour, on a diet consisting of milk and vegetable food; and I should have no hesitation in prescribing for all criminals under short terms of imprisonment a diet consisting wholly of bread and potatoes. I think that the experience acquired at the Devizes House of Correction, at Stafford, and at Glasgow would be complete justification for such a dietary."

These are a few examples of a non-flesh dietary, and later on I may be able to adduce more of recent date, showing that health, strength, &c., can be kept up without flesh. I also hope that our prisons and workhouses may be supplied with such diet, for the thousands of vegetarians in this country show that flesh is not a necessity.—By T. R. Allinson, L.R.C.P.

THE RECENT ECLIPSE OF THE MOON.

WRITING from Broughty Ferry, "Senex" tells us that all the earlier phases of the eclipse were only seen there through thick cloud and mist. The sky, however, cleared somewhat by 9h. 45m., after which my correspondent goes on to say:—"And we saw the Moon as a whitish blotch with the naked eye, but as a complete disc of dirty white in the telescope; no red colour, and the 'mares' quite black. About 10.20 p.m., the north-east limb began to show brightness, and then the copper colour crept over the Moon, and remained visible until the close of totality, and was then replaced by a beautiful blue arc, delicately shaded, which continued for ten or fifteen minutes, and then vanished. After this the shadow gradually receded; but, owing apparently to the haze, the edge of it was quite ragged."

"Hallyards," dating from Pornic (France), says:—"The sky here was extremely clear during the whole time; the Moon did not disappear entirely (as sometimes) nor did her whole disk remain visible, as usual, during the whole of totality, but a very trifling part, that nearest the limb of reappearance, and even this did not uniformly extend up to the limb; so that an ill-defined, varying, nebulous patch seemed hung up aloft; a new comet or nebula. At the beginning of totality, the light flickered about the disk like a dying candle for some time. Once only, for a moment or two, I saw the whole circle of the disk (naked eye all the time). After enough of the disk had reappeared to cast a shadow, I still saw the copper-coloured segment, which had remained visible all the time. This I mention as a test of eyesight. As seen from the Moon, the Earth is surrounded by a brilliant ring of light—refracted sunshine in our atmosphere. (Will not the solar corona also afford a notable contribution?) This is the cause of the moon not disappearing always totally; but this cause (or two causes) must give a *constant* amount of light. What, then, is the reason of the *flickering* of the light on the lunar disk? May it be due to an auroral self-luminosity of our atmosphere? Why is the Moon sometimes entirely invisible? Supposing her even in the centre of the shadow, and at perigee while we are in aphelion, would it not still be probable that our ring of sun-lit air would be bright enough to show her in some degree?—considering that the light of the crescent earth does so sometimes—and a continuous ring of refracted sunlight should be surely stronger than a half-earth of reflected light."

A correspondent, who signs himself "E. C. H.," writes as under:—

"Sir,—I watched the eclipse of last Saturday from Worthing Pier, and was much struck with its difference from other lunar eclipses that I have noticed, though the difference did not seem to be perceived by the friends who were with me at the time, or by those whom I have spoken to about it since. It was certainly the darkest eclipse I ever saw, and the moon, when entirely covered by the shadow, instead of assuming the 'appearance of a huge, glowing, coppery-red ball hung up in the sky' (to use, Sir, your words in Knowledge for Oct. 10), was visible only as a patch of dull, ashen-gray; I should hardly describe it as 'sickly green,' it was too neutral-tinted for that. This was the appearance as seen with the unaided eye; when I looked through a binocular glass that I had taken with me, I could make out the moon's circular shape, as I also could a little before totality, but not long before."

[The interesting point in the above communications lies in the fact of the faint, sickly-green hue of the visible limb of the Moon at the time of totality, and the change of the tint of the Earth's shadow to copper-colour at a later stage of the eclipse. (The latter change "Senex" says (writing subsequently) was not seen at all in Arbroath, Forfar, Dundee, &c., when the sky was clear. Hence he is disposed to refer to it in some way to the haze prevailing at Broughty Ferry.) This suggests the idea that during the first half of the eclipse a densely cloud-laden atmospheric ring must have surrounded the Earth in a direction at right angles to the Sun's rays; but that the Earth's rotation must, later on, have brought a more transparent annulus into the same position. Obviously, were our atmosphere *filled* with dense clouds, no refraction of the solar light into the umbra could take place, and the Moon would seemingly disappear entirely.—Ed.]

Government Inspectors.—A return has been issued by the Home Office of the number of inspectors in the employ of the several departments of the Government, and the amount of the fixed salaries paid to them. It is as follows:—England.—Privy Council Office—Agricultural Department, 27, £5,420; Education Department, 259, £105,075; Education (Scotch) Department, 48, £29,070; Science and Art Department, 4, £1,865. Home Office.—Inspectors of Factories, 56, £21,988; Inspectors of Mines, 26, £15,642; Inspectors of Fisheries, 2, £953; Inspector of Burial Grounds, 1, £500; Inspectors of Reformatories and Industrial Schools, 3, £1,386; Inspectors of Constabulary, 4, £3,300; Inspectors of Explosives, 3, £2,400; Inspector under the Cruelty to Animals Act, 1, £210; Inspectors of Anatomy, 3, £1,060; Inspector under the Habitual Drunkards Act, 1; Inspector of Rivers Pollution (Scotland), 1, £50. Board of Trade.—Railway Department, 4, £4,400; Marine Department, 124, £41,980; Commercial Department, 3, £365; Inland Revenue, 53, £28,310; Local Government Board, 56, £39,080; General Register Office, 2, £1,180; Charity Commission, 3, £2,400; total, 684, £297,634. Scotland.—Fishery Board, 3, £1,165; General Board of Commissioners in Lunacy, 4, £3,200; Board of Supervision, 3, £1,400; total, 10, £5,765. Grand total, 694 inspectors, and £303,399 salaries.

Miscellanea.

Mr. W. Crookes, F.R.S., and Drs. W. Odling and C. Meymott Tidy, reporting to Colonel Sir Francis Bolton, official water examiner for the metropolis, on the composition and quality of daily samples of water supplies to London last month, state that of the 168 samples derived from the mains of the seven metropolitan water companies taking their supply from the Thames and the Lea, "the whole were, without exception, clear, bright, and well filtered. The excellence of the water supplied to the metropolis during August was indicated by its state of aëration, and by its freedom from colour and from any excess of organic matter. Further, its perfect filtration was evident by the absence of even a trace of suspended matter in any one of the numerous samples submitted to examination."

The experiments on the relative efficiency of different illuminants for lighthouse purposes which are being carried out by the Trinity Brethren, aided by the observations of the captains of the mail packets, the Peninsular and Oriental liners, pilot vessels of different nationalities using the channel, trading vessels plying between England and foreign ports, and by several French cruisers have in some respects been completed. They support the conclusions previously arrived at. So far as has been ascertained at present, there seems to be very little difference for all practical purposes between gas and paraffin oil. The gas-light, if anything, is slightly superior in fine weather, and the electric light is overwhelmingly superior to both the other lights. The crucial test of the electric light, however, will be in hazy weather, and it is stated that in some experiments which have already taken place when the weather was rather thick the light did not hold its own against the other luminants. Important tests will take place during the autumn, into which the experiments will be extended, when hazy weather and a greater variety in the conditions of the atmosphere may be expected.

Extent and Resources of Great Britain.—Those who are looking for statistics may find some rather startling figures in the address recently delivered by Sir Richard Temple on "Economic Science and Statistics" before the British Association at Montreal. On this authority it appears that the area of the British Empire is eight and a half million square miles. Including countries politically under its control, such as Egypt, Zululand, and Afghanistan, the total amounts to ten million square miles, or one-fifth of the habitable globe. One-quarter of this area has been topographically surveyed. The total coast-line is 28,500 miles, with 48 large harbours. Only one-fifth of the area is cultivated or occupied. There is room enough in Canada and Australia to support a population of 200,000,000. The total population of the empire amounts to 315,000,000, of which 39,000,000 are Anglo-Saxons and 188,000,000 are Hindoos. The annual revenue amounts to £203,000,000 of which sum £89,000,000 come from the United Kingdom, £74,000,000 from India, and £40,000,000 from the colonies and dependencies. Only one-forth of the total revenue is derived from land taxation. Including local taxation the revenue is £264,000,000, and amounts to £1. 5s. 4d. per head per annum. The number of men trained to arms amounts to 850,000, about 700,000 of these being of the fair and dominant race. The defensive armaments by sea and land cost £41,000,000 annually, which is less than that shown by any great State in the world except in the United States. There are 560,000 policemen in the empire, 1 to every 571 inhabitants and to every 16 square miles. There are 246 war-vessels, and 30,000 merchant ships manned by 270,000 sailors. The factory steam power in the world is represented by 7,500,000 horse power; of that total 2,250,000, or about 30 per cent., is British. If the main elements of national industry be taken together—namely, commerce, manufactures, mining, agriculture, carrying trade, and bankin—the total £2,000,000,000 and upward annually is about the same for the United Kingdom and the United States. But the United States are advancing the fastest, and are already passing ahead. There are 675,000 persons convicted annually of crime in the empire, of which number more than nineteen-twentieths pertain to India. The number of paupers in the United Kingdom under relief amonnts to 1,000,000, or rather less than one-thirtieth of the population, and the cost of their maintenance is £10,000,000 sterling annually. In regard to the Post-Office, the letters posted annually in the world are 5,200,000,000; of this total 1,500,000,000, or 34 per cent., are in the British empire. Respecting education, there are 5,250,000 pupils at schools in the United Kingdom, 860,000 in Canada, 611,000 in Australia, and 2,200,000 in India, making a total of 8,921,000 pupils in the British Empire.

"Let Knowledge grow from more to more."—Alfred Tennyson.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the Editor of Knowledge; *all Business communications to the* Publishers, *at the Office, 74, Great Queen-street, W.C.* If this is not attended to delays arise for which the Editor is not responsible.

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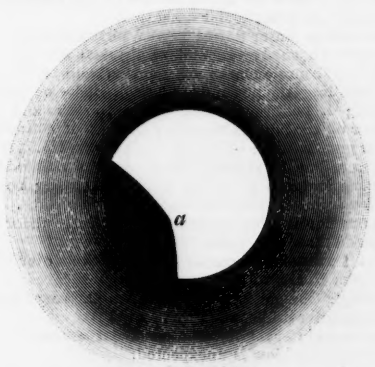
THE LUNAR ECLIPSE OF OCTOBER 4.

[1451]—That well-known Belgian astronomer, my friend M. Ad. de Boë, of Antwerp, sends me an account of so remarkable and interesting an observation of his own of the eclipse of Saturday week that I am induced to hope that you will find space for a *précis* as short as I can make of it.



Briefly, then, at the stage of the eclipse represented in the annexed slightly exaggerated diagram the arc of the earth's shadow was quite decidedly peaked at *a* instead of being rigidly circular. "Il n'y a (says M. de Boë) dans cette observation aucune illusion. Deux personnes présentes la constaterent immédiatement." Now, at the time of the phase indicated, the moon *was on the horizon of the Cordilleras*, while when she was half eclipsed she was similarly placed as regards part of the Pacific Ocean. At this time, however, all traces of the peaked appearance had absolutely vanished, and the periphery of the shadow was sensibly circular. Can the curious deformation figured have been the shadow of the Cordilleras, or had it its origin in the form of the lunar surface?

From all my friends abroad and at home I hear of the curious phosphorescent green tint of the earth's shadow during totality, a phenomenon which struck me forcibly in observing the eclipse myself. William Noble.

Forest Lodge, Oct. 13, 1884.

INFLUENCE OF MOONLIGHT.

[1452]—The following, partly for its bearing on Mr. Hays' letter (1445), partly to elicit information on the subject mentioned. A fellow tourist last summer, noticing that I had slept with my bedroom windows open, greeted me with "You will some day catch an ophthalmia." In further conversation on the subject I was told that an inquiry had been made by French surgeons as to the cause of ophthalmia, which had been noticed to be prevalent among French soldiers in Algeria while camping out. It was found that the sufferers were in general men who, not liking their small close tents, would sleep out in the open. Since the inquiry the men are

allowed to sleep outside their tents, provided they wear a warm protective bandage over the eyes. My informant was a stranger to me, but I have no doubt the above is in the main correct.

That a sleeper in the moonlight runs the risk of waking blind, or with his face distorted is a very prevalent belief among sailors. Probably the fact that the face of the sleeper is cold—perhaps very cold—for some hours together is a sufficient reason for the effects occasionally observed.

As regards the mackerel, however, although, as the Editor remarks, moisture in conjunction with heat is a most fertile agent in decomposition, it is difficult to see how *cold*, whether produced by radiation or otherwise, can be damaging; perhaps germs settling down in the still air with the dew may be the culprits, if any; or, perhaps, Pliny and Plutarch notwithstanding, King Charles's fish question is pertinent. A. Le Sueur.

"LIFE AFTER DEATH."

[1453]—Before we can even reasonably speculate as to what happens at death, it would seem advisable to find out, if possible, what really happened in cases such as the one referred to by Mr. Thorne and in analogous cases. And it would be well if the experiences were kept clearly distinct under the heads of subjective and observed.

In the hope that some good will come of this suggestion, I give my experiences under the heads of drowning, anæsthetics, sleep, fainting from weakness, effects of a violent blow. I may say these are entirely subjective experiences; what I have observed I reserve as being in my opinion not so important.

I make no inferences, as I hold that at present we know too little of the subject to enable us to do so with any approach to accuracy. The sensations or feelings are given in the *order* of occurrence; but I have no consciousness of the relative length of time elapsing for each particular sensation.

A.—Immersion in water until "loss of physical power, thought, and consciousness ensued:—1. Violent physical struggle to obtain air; 2. Mental consciousness of danger, and vivid action of memory in recalling the actions of life; 3. Sense of weight, darkness, and cold; 4. Loss of physical power to move and feeling; 5. Loss of power of continuous thought; 6. Loss of consciousness.

B.—Under anæsthetics:—Change begins with No. 3, and follows the same order, but in several trials I do not remember ever to have lost consciousness of being, although having no power to reason or even form a concept of what was taking place. This particular phenomenon is more apparent in my case under the action of nitrous oxide than with chloroform.

C.—Sleep: I cannot at present separate the order of feelings. They seem from Nos. 3 to 6 instantaneous.

D.—Fainting: Change begins with No. 3, very marked, but there seems no interval between this and 6.

E.—There is no interval between consciousness and loss of consciousness where the blow is unexpected.

It is worthy of notice that in all these states there are two things common. The action of the heart has never entirely and totally ceased, and the limit of phenomena, except in B, is the same—viz., "loss of consciousness," and therefore I fail to see why A is death any more than C, D, or E.

If this is correct, why draw conclusions from A that cannot be drawn from the other states? Until we know more of the nature of life and mind, it seems hopeless to expect to unravel the problem of the effect of the cessation of life on mind. Supposing mind to have a separate existence from physical life, it seems hardly likely that the cessation of this life will affect it. If mind and physical life are one, then death must destroy both. It seems to me, therefore, the solution of Mr. Thorne's problem depends on the solution of the questions relating to the nature and relationships of life and mind. J. C. H.

[1454]—Your correspondent "Selwyn Thorne" appears to imagine that he has made an important case against those who believe in a life after death. But he has done so by being singularly illogical. Negations are usually regarded as somewhat difficult of proof; but he has undertaken to prove a negation by a mere assumption. He assumes that which every sane man will doubt, *that the man was dead*, and says, "he lay at the bottom of the water, to all intents and purposes stone dead." I believe that there is not one single instance recorded in medical experience (of course, I am not speaking now of Biblical cases) where total death has taken place and the patient has been resuscitated. Medical men tell us that the heart beats and there is some sort of circulation long after apparent death; but here there was no length of time, or resuscitation would not have taken place. To argue that because this man saw or pretended to know nothing, that, therefore, *something* does not exist is very rich indeed. Besides, his experience is certainly different from the bulk of those who are recovered from apparent death (for it is in such cases *only* apparent) from drowning. I have known and conversed with several who have been drawn from the water in a similar state, and their testimony is unanimous in describing not a total suspension of the mental faculties, but an extraordinary state of intromission, in which, while dead to all around, they lived over again, in a moment of time, the events of years of their lives. The logic of the fourth paragraph is certainly beyond my comprehension, especially in its conclusion. We shall require something more than Mr. Thorne's "probability" to induce us to accept his position. E. M.

[I have myself conversed with a professional rowing man who was "drowned," and who described this "intromission," or crowding of the events of his life into a seemingly few seconds, as preceding total insensibility.—Ed.]

[1455]—The instance cited by Mr. Thorne is one of restored "sensation" (vitality), not of restored "animation" (soul endowment); in common parlance, the one expression conveys the same meaning as the other, although there is a wide distinction. Chloroforming, under certain conditions, may occasion sensations similar to death by suffocation. It results (first stage) in suspension of sensation. Keep the patient too long under chloroform and death (second stage) ensues in addition to insensibility.

The "drowned" man had reached the first stage—the half-way house—but not the second stage—"the undiscover'd country from whose bourne no traveller returns."

Apply M. Figuier's definition (quoted immediately above Mr. Thorne's letter), "Man consists of three elements—body, life, and soul." The life had gone out of the "drowned" man, but not the soul. He had no "post-mortem" experiences to record; had he remained as many hours under water as he did minutes, and then been able to narrate his experiences, they would have been original and interesting. C. J. T.

[1456]—The question which Mr. Thorne has raised in your issue of Oct. 3, concerning an "after-life" may, I think, be satisfactorily answered in the affirmative from a purely scientific point of view, if you will allow me a few lines to explain a theory which, although it *may* be wrong, appears to me somewhat conclusive.

Mr. Thorne tells us that the person whose restoration from an apparently drowned state he witnessed could remember nothing from the time of his dying last effort until the moment of returning consciousness, that is to say, he had no idea as to the duration of time, and (to his senses) the moment his faculties failed, the self-same moment came the dawn of returning life. This is important.

Now, let us suppose (as the opponents of after-life ideas would have us suppose) that man is a chance production of "force" and "matter," the "mind" or "life" bearing the same relation to the physical forces as the body does to the substantial elements—namely, an elaborate and intricate compound, death being the severance of these, or the want of unison between them, the same natural forces existing after death, just as the chemical elements of the body remain intact after death, although assuming different forms and compounds.

It must be evident, then, that, by the natural laws of "chance," at some future time (a long time, I will admit, but science can place no limit to time), these elements (physical and chemical) must inevitably be brought together in exactly the same compounds and positions as formerly, the only requisite being sufficient time, just as (on a colossal scale) a number of coloured balls, placed in a bag, when drawn out at random, are capable of producing ten thousand different orders of succession, any given order must recur and recur again indefinitely if the balls be drawn out a sufficient number of times.

If, then, a person is unconscious of time after the moment of death, as we must admit, this resuscitation must come upon him almost instantaneously, despite the enormous extent of time which may have elapsed. We have all heard, at one time or another, of persons who, during illness, have remained unconscious for many days together, and, upon returning to their former self, have not a faint idea of the lapse of time.

If there is any error in this reasoning, I hope to be enlightened, as I fail to see any. Trusting this letter may prove interesting to some of your readers, Alex. Mackie.

[1457]—I think no satisfactory answer can be given to the main question in Mr. Selwyn Thorne's letter, No. 1436, concerning the future life. Whether we believe in such a state or not, no one can *know*.

Analogous to heat and light, the materialists regard the phenomena of thought as a form of motion of the molecules of the

brain. Possibly such motions may play a part in the creation of thought and emotion, but I incline to the idea that behind the brain there must be an intelligence, a soul, to take cognisance of and to control these motions.

The body during life is always dying, the lost materials being as constantly renewed. At death the elements of which it is composed, may according to its disposal, from a few moments to a lengthened period, form parts of the bodies of numberless plants and animals, including man himself. Never permanent, but undergoing diffusion from birth to death and after, the belief in the resurrection of the body cannot be entertained.

If there be a mortal soul, or no immortal soul, death ends all.

If, on the other hand, there be an immortal soul, the belief generally accepted, the offspring partly of early training, and one supported too by the inborn craving man has for knowledge, a powerful argument in favour of the belief, pointing as it does to some benefit or use which is to be made of such acquirements hereafter; the question arises, what becomes of this soul?

For my part, I think it has a future untrammelled by a material body, with enlarged powers of intellect, locomotion, and senses. But at best this is only speculation—an opinion; we have nothing to guide us.

Referring to the incident that gave rise to Mr. Thorne's letter, I do not see how the experience of an apparently drowned man can throw any light upon the question of a future state. This man, after suffering from the drowning process, in from one and a half to three or four minutes becomes oblivious. He is asphyxiated. Thought and consciousness are at an end, he knows and feels nothing whatever. He appears to be stone dead, but he is really alive; asphyxia being only an abnormal phase of life.

For six or eight hours out of the twenty-four, when in health, we are all, during sound sleep, putting aside the suffering attending drowning, and the cessation of the heart's action, in the same state—that is, absolutely without thought and consciousness, knowing and feeling nothing whatever.

How can a person in such a condition obtain any insight into any subject, much less in one so abstruse as the unknown attributes of a future life?

What we want is what we shall never get—the experience of some one who has passed the portal we call death, not that of one who has only approached it, practically as unconscious as a sound sleeper.

Whether science will ever directly satisfy the natural curiosity all feel regarding the after-life, who can tell? There appears little hope of any direct evidence on the subject ever manifesting itself. It seems rather destined to remain enveloped in mystery.

EYE-WITNESS.

[1458]—Of course, the obvious reply to Mr. Selwyn Thorne's letter (1436) is, that the man was never really dead. But, admitting the supposition that, had he died, he would have been unconscious of any further sensation, it would hardly have proved there is no life after death. The instance given rather proves that sensation can be totally suspended for a time, and reproduced with all its former effects. The majority of religious systems which deal with the question of a life after death, provide a material body of some kind in which the spirit may dwell, and on which it may exercise its influence.

Most thinking men of the present day, irrespective of creed, are divided into two classes—materialists and spiritualists—those who believe that matter itself contains the power which alters its form, and those who believe that matter itself is dead, and the power which gives it motion and life is outside. The materialist merely sees in the human body a combination of particles which produces what is called life, and as soon as that particular combination is broken up, life is destroyed. The spiritualist, on the other hand, sees a force acting on a certain combination of particles, and so long as that combination continues, so long does the force act on it. When the combination is broken up, the force ceases to act. But some spiritualists further believe that the same force, after remaining dormant in the meanwhile, may, at some future time, act on a similar combination of particles, and resuscitate in the new combination sensations which were felt in the former combination.

Nothing can be proved for or against either supposition. For my own part I find it easier to believe in spirit acting on matter, than in matter endued with life; and, with the imperfect knowledge I have of science, there appears to me an impassable gulf between so-called dead and living matter; for physicists tell me that the composition of a man's body, just killed by a bullet in his heart, is the same as it was a moment before, when he was full of life and strength. I can understand a watch stopping when the mainspring is broken, because the power in the mainspring is an external power, transmitted to it when the watch was wound up. But, unless some external power winds up a man in the same way, I cannot understand why stopping the action of the heart should destroy life in the rest of the body. Life is not sensation, life is not consciousness, and life is not intelligence. All these and each can be destroyed and life continue; but once destroy life and it cannot be restored. Sensation may come back, consciousness may be renewed, and intelligence may return after many years' absence, but on this earth, except by a miracle, life once lost can never be found again.

JOS. W. ALEXANDER.

[1459]—Admitting the hypothesis that the man was *really* dead, and that his spirit existed for awhile apart from his body, is it in accordance—I will not say with psychological, a science but little understood—but with physiological teaching, to suppose that a brain dead to all thoughts and nerves, dead to all sensations, could reproduce the thoughts or emotions experienced in a spiritual state of existence?

A. E. S.

DEATH BY LIGHTNING.

[1460]—On reading the paper in KNOWLEDGE, p. 258, which purports to be derived from one by Dr. J. Rouyer in *La Nature*, it appears to me that some of the statements are much at variance with all that we know of the effects of lightning.

I do not at all dispute the correctness of the assertion that in many of these cases death is so sudden that the attitude of the moment when death occurs is retained for a time after. But I think No. 4 is very doubtful, and No. 8 is so entirely improbable (viz., the sudden resolution into a heap of ashes) that it would have been well to add a note to the effect that the statement must be taken *cum grano salis*, and then that it would be difficult to swallow.

GEO. D. BROWN, F.L.S.

THE "WESTMINSTER PAPERS."

[1461]—At p. 287 of KNOWLEDGE a question is asked as to whether the "Westminster Papers" are now procurable, &c. The last issue was dated April 1, 1879, the publishers being the Civil Service Printing and Publishing Company, Limited, 8, Salisbury-court, Fleet-street, and Kent & Co., Paternoster-row. I cannot say whether all or any parts of these papers are now procurable. I possess the whole series of eleven volumes, and value them too much to be induced to part with them, except at a price that would probably be prohibitive.

I should think it will be difficult to purchase a complete set.

GEO. D. BROWN.

ANIMAL (?) AND MINERAL MAGNETISM.

[1462]—As is well known, Reichenbach describes an experiment in which the needle of a compass was moved by the finger of a so-called "sensitive," merely pointed at it, and he argues from this a connection between mineral and animal magnetism. The possibility of such a thing has been strenuously denied by the scientific world in general, and I am far from maintaining it; but there is a somewhat similar experiment which I have frequently performed, and which may have tempted Reichenbach to a rash conclusion. It is this: By passing my finger (sometimes only once) over the glass cover of the compass, and in contact with it, one end of the needle may be made to adhere to the glass. If now my finger is brought near it when in this position, the needle will certainly be moved, that is to say, it will be repelled from my finger.

I should imagine that this phenomenon admits of a very simple scientific explanation. I presume that the needle adheres to the glass because the latter has been electrified by the previous friction, and that then the change of temperature produced by the proximity of the finger repels the needle. Is this a correct and sufficient explanation? Certainly the finger does not act as a magnet, for it repels equally either end of the needle.

It seems to me that the experiment is interesting, if only as tending to explain how the idea of "animal magnetism" may have originated.

A. EUBULE-EVANS.

BREEDING IN AND IN.

[1463]—Some weeks ago an article appeared in your paper which broached the theory that the poor unfortunates to whom sight with its boundless joys, and speech in which to give them utterance, are denied, owe their ills to the thoughtlessness or sin of their parents marrying within the proscribed degrees. I have come across some facts, probably known long since, bearing if not upon this issue, still upon one having an analogy to it.

At farmyards cats are absolutely necessary. One well-known to me in boyhood became the home of a splendid tortoiseshell cat. She found no rivals. In the country dogs and lads often form

stabler offensive leagues against the feline race than ever Christian emperors can against their neighbours. However, the new cat undoubtely found lovers. In due course she founded a clan seemingly destined to rival the British race in number. But fate, or rather nature, ruled otherwise. Continued inter-breeding did its work.

At one time the family numbered some forty. Here the decline began. Snifters, as the disease is locally and onomatopœiacally called, appeared—a complaint in which, I believe, breathing becomes difficult, and, as a consequence, the poor animals grow thin and mangy. Eating entails torture. Awhile they linger, and deaths comes, a welcome relief.

Maimed specimens were common. Many wanted ears and tails, wholly or in part (can the Isle of Man cats owe their hideous deformity in any way to this?). One had no nostrils.

On the same farm a mare, which had been unwittingly placed in a field along with a half-brother on the male side, gave birth to a foal deformed in various parts. Besides wanting ears and nostrils, one of the legs was only half the proper length, no hoof, but clean off as if amputated and then healed.

I mentioned Manx cats. Did it ever strike you that etymologists, being word-twisters, have overlooked the obvious significance of the name "Isle of Man?" Why go back to the names of ancient kings for the derivation? Take the plain Anglo-Saxon Man, the human race. May it not be a remnant of the truth? May not the island have been the scene of the slow transition of present man from a more ancient type? The cats are tailless. May man not have at least lost his prehensile tail in Mona's bright glens, or on her bleak mountains? Tails would be useless, for Mona sorrows in her scarcity of trees. Please don't call this a paradox. Accept my wishes for the increased usefulness of Knowledge, and for continued health to yourself. To me the greatest charm in Knowledge is the close connection between yourself, your contributors, and your readers. All form as it were a vast literary co-operative society, knit together by friendship.

Jas. Hornell.

A FLIGHT OF HAY.

[1464]—June 17, 1884, very fine weather, wind N.E., just strong enough to turn the sails of a mill, a good deal of hay passed over my house. Some fell, other lots sailed on; two large armfuls I watched as far as the sea—half a mile. They took about five minutes to do it, so the wind may be put at six miles an hour. They did not seem any lower in the air.

I suppose that the air, heated in the hollow stalks, and also in the mass of hay, had become so much lighter than the surrounding air, that, a gust or eddy having started them from some field to windward of me, they could not sink. But I never saw a similar occurrence in my life before. Hallyards.

MIND AND BRAIN.

[1465]—May I be allowed to supplement previous letters on the above subjects with a few remarks? *Soul* is the Anglo-Saxon word *self*, and is equivalent to the whole person; it is also a term used to represent *animal life*. *Spirit* is that which we breathe, and contains *power* to develope thought out of brain-substance in a suitable organisation. When a man ceases to breathe he ceases to think; this proves the dependence on each other of breath and thought. The thoughts that spring from a living person are common to all mankind, and are as *natural* as the spirit (or breath) that generates them or enables them to be generated. Hence, neither soul, nor life, nor spirit is necessarily immortal, for they are part and parcel of the nature common to all created things. These remarks do not apply to the "power that maketh for righteousness," which, being eternal, must necessarily be the "same yesterday, to-day, and for ever." J. C. H.

[But if it be true that "when a man ceases to breathe he ceases to think," a diver must be unconscious until he comes to the top of the water again.—Ed.]

BRAIN POWER.

[1466]—Mr. W. H. Jones, in his letter (No. 1444), which appeared in your issue of Oct. 10, is opening up a wide question—to wit, the true nature of "genius." Is "genius" to be defined, with Johnson, as implying "large general powers accidentally determined in some particular direction?"

Is it possible to say that, with a different training, a Shakespeare might have become a Napoleon, or a Titian might have developed into a Bismarck? Or shall we be nearer the mark if we say that genius is always one-sided; that a man's brain is of such a nature that its possessor can achieve the foremost rank in one department of knowledge, and one only?

Surely this latter theory has more inherent probability than the former; and if so, "the man whose brain had three parts each equal to seven, but all the rest varying from one to four," would in all probability "produce greater effect, be a greater genius," than the "man all the parts of whose brain marked five."

A. F. Osborne.

LETTERS RECEIVED AND SHORT ANSWERS.

E. Swinn. From the bending of the sun's rays within the shadow cone by refraction in the earth's atmosphere.—An Undergraduate. Yours is one of the seventy or eighty letters which have reached me contending that no one can be said to be dead who is susceptible of resuscitation. Mathematics take their turn with other subjects, as Knowledge addresses a very large *clientèle* of the most diverse possible tastes. Thanks for friendly wishes.—Protea. It is very probable indeed, though not absolutely certain, that Dr. Huggins has succeeded in photographing the corona of the uneclipsed sun. The strongest piece of corroborative evidence is, I think, to be found in the occurrence of a rift in one of Dr. H.'s photographed coronæ, which was seen during an eclipse which was elsewhere total at the time the photograph was taken. It is impossible in the existing state of our knowledge to say what is the mass of the 250 planetoids already discovered, and, *à fortiori*, of those which still remain to be found. The total mass, however, must be relatively very small.—Thomas Thomas and J. Kennedy Esdaile. Forwarded to publishers. For the twentieth time, the *Editor* does not supply copies of this journal.—J. W. Kearton. Your otherwise excellent and thoughtful letter does not help much towards the solution of the difficulty.—F. S. L., Q. T. V., W. J. W., and others continue to send solutions of Mr. Sidder's figure-puzzle.—W. A. The calculation of each eclipse requires a considerable amount of mathematical knowledge, and is very operose indeed, involving the taking out of whole columns of logarithms. If a sufficient number of readers cared, however, for an explanation of a *graphical* method of approximately predicting the details of a Lunar Eclipse, I might perhaps give it in these columns.—Jas. N. Kirby. "Tricycling for Ladies" is published by Iliffe & Son, 98, Fleet-street, London.—May Kendall. Many thanks for your really charming translation of the Prologue to "Faust," but the mere press of scientific matter on these columns would prevent the insertion of poetry at present, even were such insertion customary.—W. J. W. Your hint about barometric indications shall be considered.—A. C. M. T. Write to E. W. Maunder, Esq., Royal Observatory, Greenwich.—The Ghost of a little Dog. Your jeu d'esprit leaves the formidable objection of "C. R." quite untouched.—T. E. Weller. Narrating the experience of a brother who was drowned and resuscitated, says that, lying at the bottom of the water, the drowning man seemed to be surrounded by coruscations of light prior to becoming insensible. This is one of the most familiar sensations attendant on congestion of the brain, and is said to occur in a certain stage of intoxication, and in hanging. I have experienced it myself while inhaling chloroform for experimental purposes, and we all know how a blow on the head causes its recipient to "see stars."—W. Jerome Harrison, F.G.S. Received with thanks. The pressure on our space just now, though, is so tremendous (we have a hundred columns of matter up in type waiting for insertion) that it must, perforce, be some time before it can possibly appear.—Hallyards. Two letters of yours of scientific interest are marked for insertion; to reproduce the rest of your curiously miscellaneous matter would almost necessitate a supplement. I am more in accordance with you on the question of Royalty than you think. Your American friend who stated that the conductor of this journal is not a Cambridge graduate told you a deliberate —— (Well, let us say it may be expressed by a Saxon word of three letters). Thanks for your vindication. The paragraph to which you take exception dealt with much more than a mere misprint. Read it again. I hope that you haven't been overburdened with poetry in Knowledge lately. I have received very different criticisms to yours on the Fontenelle papers. As to reproducing the Almagest! the laborious work of Copernicus, or Kepler's wild dreams and fantasies here—where is the space to come from? "Venus in Sole Visâ" has already been well translated, and appeared in a compendious form in English. I have noticed a few of your points, but am rapidly emptying *my* inkbottle too.—S. W. Goodeve's volume in Longmans' "Text-books of Science" ought to suit you. You will also find a quantity of useful information on the subject of mechanics generally in "The Student's Mechanics," by the late lamented Walter R. Browne. I have not seen Prof. Cotterell's book.—T. W. Cave. *Quot homines, tot sententiæ.* If you can elucidate the subject from a scientific point of view, you need not fear that your letter will remain unread.—Erasmus Beynon suggests, with reference to the case of a man insensible from drowning, illness, &c., that, as the brain is, *pro tempore*, non-recipient, so it can give nothing out; can have no new sensation to

reveal on recovering to its normal state, and "consequently the soul cannot put itself in evidence."—Miss L. W. Tomlinson and others send accounts of the afterglows, which appear to be once more increasing in intensity.—W. H. Harrison. Many thanks, but our columns are crowded to an extent in excess of any previous experience. The puzzle is really what to do with matter already in type. B. M., F.R.C.S., M. C. N., E. W. J., Rev. F. S. Lea, C. E. D., W. C. P., F., A. E. S., A. Bennett, W. H., H. B. L., W. H. S. Monck, W., and others writing on the subject of "Life after Death," one and all reiterate, in various forms, the argument from the analogy of the condition of the drowned man to that of a person unconscious from sleep, the effect of narcotics or anæsthetics, or from disease.—John Bell. Your letter on the same subject is excluded by its length. This remark applies, too, to the very clever and well-reasoned letters of Lancashire Mon, Chas. Rose, W. T. E., and J. T. Routledge. The present pressure on our limited space is tremendous.—T. Common. You run dangerously near the boundary line—even if you do not actually cross it.—H'sett tells a story of a wealthy Jew who won a bet of £10, and £80 besides, at poker of a Californian gambler while crossing the Atlantic.—Alfred Kitson. You ignore the fact that I most carefully investigated the subject for myself. I will not waste too precious space by admitting its discussion here. Your attempt to do so indirectly is shrewd enough, but "I think *not*," said the lamb.—Dr. Cory. I inserted the letter of "F. S." solely on the principle *Audi alteram partem*, albeit I am absolutely in accord with you that vaccination is "one of the most benificent medical appliances that has ever been used." I wish that you could see your way to a material condensation of your argument, as the great length of your communication entirely precludes its insertion. With—as I have said elsewhere—100 columns of matter actually standing in type; with "Editorial Gossip," Reviews, &c., hopelessly crowded out, it will be impossible, for some time to come, to insert any letters but those very briefly worded.—Chas. J. Ryan. Undoubtedly. A small spectroscope fitted to a 5½ in. reflector would show you the lines in the solar prominences. A rainband one would do so perfectly. You might even see the prominences themselves if you chose to risk blinding yourself. Alcyone is *not* "the central sun round which the solar system revolves."—A. E. Conte. Your postal order and stamps forwarded to the *Publishers*. The Editor has nothing to do with such matters.—Nigel Doble. No, the data are insufficient. You cannot even find the hour angle of a star from the meridian without knowing the latitude and its declination, as well as its altitude. Given the declination of a star, its hour angle, and the latitude of the place, though, its altitude and azimuth may be determined.—Theodore Bell. No, the motion of the sea or air might be converted into heat, but the converse is impracticable. Difference of temperature is a *sine quâ non* in the development of mechanical energy. If every part of a steam-engine, for example, were equally heated, it would cease to act.—W. I had many scores of solutions of the Figure Puzzle, which I wish, with all my heart, now *had* been sent to "The Family Tea-tray." Any succinct explanation of its theory would have been inserted, but none such reached us. With reference to "Coincidences" it may—or may not—be that the two multitudes were identical. This in no way affects the fact that they were, or are, multitudes.—Knowledge addresses readers of the most diverse possible tastes. One man wants it to consist mainly of mathematical papers; another thinks it should be filled with tricycling; a third (with, I fear, much more reason) that geology is neglected, and so on. Do you remember the fable of the old man and his ass?

[The "Life after Death" controversy must now terminate, as it is seriously encroaching on our space, to the exclusion of other subjects of interest. A few more letters (already marked for insertion, on account of their containing more or less novel contributions to the discussion) will appear, but none subsequently received will do so.]

The International Electrical Exhibition at Philadelphia, which was highly successful, the receipts largely exceeding the expenses, was closed on Saturday night.

Errata.—Page 302, first paragraph of Editorial Gossip, for "decensus" read "descensus." Page 303, Review of "Technological Examinations, &c.," delete comma after "devoted," and read "devoted the money"; delete also the word "and" after "Brompton." Page 306, column two, "Ephermeris" should be "Ephemeris"; and, in reply to Roland Ellis, "his surface" is printed for "her surface." In footnote to Letter 1449 (p. 306), delete the comma after "laterally," and for "and it is in" read "than it is in."

The Inventors' Column.

So great is the number of inventions now patented that many good things are comparatively lost in the crowd. A succinct account, therefore, by an Expert, of all inventions of really popular interest and utility must be advantageous both to the public and the Inventor, enabling persons to hear of inventions already desiderated by them, and thus acting reciprocally as a stimulant on supply and demand.

AN IMPROVED SASH-FASTENER.

Irrespective of the want of security in ordinary window-catches, they do not even exclude draught or prevent the sashes from rattling. Wedges are clumsy and inconvenient contrivances, and the proper remedy is undoubtedly an invention like one patented by Mr. John Bennett, of 149a, Great Hampton-row, Birmingham. The device in question is simple enough. The knob of the ordinary fastener is converted into a screw-nut, which cannot become detached, and by merely turning, draws the sashes together so closely that a sheet of tissue-paper cannot be interposed. This arrangement is absolutely thief-proof and draught-proof. It is, moreover, very cheap, and should come into universal household use.

IMPROVED GLAZING.

Skylights of all kinds are notoriously troublesome, on account of leakage, notwithstanding the many patented systems of improved glazing. Mr. George Deacon, of 103, Lower Thrift-street, Northampton, has, however, invented a method of glazing suited for all kinds of roofs and horticultural buildings, which is claimed to be a perfect remedy for all the evils incidental to ordinary skylights. In this invention the rafters to carry the glass are made with a circular groove down the centre of the top edge, to carry off any water that may force a passage between the squares of glass which are laid down edge to edge on the centre of the rafter. The glass is secured by means of a galvanised iron, or, it may be, a brass, nut, provided with an indiarubber washer underneath, to prevent the breaking of the glass under pressure. The panes are made to pass the screw for the nut by cutting off the top corners under the lap. The vertical glazing is secured by a small round-headed screw. The glass butts each way. Under this system any leakage is said to be impossible.

AN IMPROVED SPANNER.

A new spanner is now being introduced by Messrs. Turner, Naylor, & Marples, of Leeds, and is claimed to be superior to the ordinary screw-wrench in several respects. Fitted, as it is, with the Clyburn-spanner motion, it can be adjusted to the work in hand with ease and correctness, and, when so adjusted, it cannot be shifted by being laid aside or thrown down. In the ordinary wrench the screw on the leg and the cutting in the body to admit the ring, weakened the tool where strength is most required. In this wrench these weaknesses are avoided, and the whole strength of the tool is made available. Another defect of the ordinary appliance is avoided, we are told, in the improved wrench by making the handle fast to the body, thus giving the user a firm grip of the tool and a thorough command of his work. The jaws are not cut, and the wrench can, consequently, be applied to bright-work without injury.

PATENT TROUGHS FOR HOLDING AND KEEPING CUT GRAPES.

Mr. George Ward, the well-known grape-grower of Bishop Stortford, has patented an invention which entirely abolishes the objections of the "bottle" method, and relieves the grower of grapes of every kind of difficulty in properly keeping grapes after they are cut. This invention is characterised by extreme simplicity. The troughs employed are oblong in shape, and about 17 in. long, and are made single and double, of glazed earthenware, which possesses the advantage of being non-porous, cleanly, and cheap; but they could be made in many other materials. Each trough has a flange or ledge, against one of its sides in the single trough, and in the middle of the double trough. The manner of using them is as follows:—The trough is filled with water nearly up to the brim. The shoot bearing the bunch of grapes is cut from the vine sufficiently long to admit of the bunch hanging free of the trough in its natural position, while the end of the shoot is inserted under the ledge or flange. The shoot acts as a lever working on the edge of the trough as a fulcrum; the weight of the grapes thus presses the end of the shoot firmly up against the ledge or flange, and the bunch then holds itself in position without any tying or fastening whatever. All grape-growers will appreciate this invention.

XUM

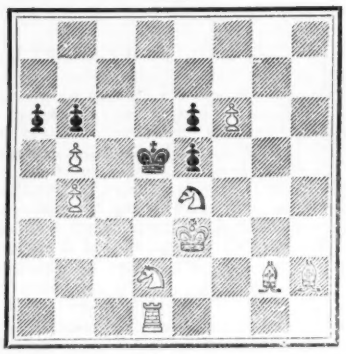
Our Chess Column.

By Mephisto.

PROBLEM No. 132.

By W. Furnival.

Black.



White.

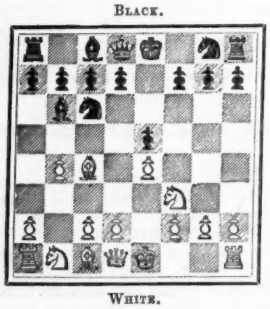
White to play and mate in three moves.

THE EVANS GAMBIT.

1. P to K4, P to K4. 2. Kt to KB3, Kt to QB3. 3. B to B4, B to B4. 4. P to QKt4. The sacrifice of this Pawn enables White, to develop his game very freely, and to obtain almost endless varieties of attack. True, the theorists maintain that with the best defence, Black ought to be able to keep an advantage, and Zukertort has given this view practical expression by betting a player large odds in off-hand games on condition that he has to take the move and play the Evans Gambit. Nevertheless, we consider this opening formidable, and dangerous to meet. We may mention that both at the Vienna and the London Tournaments Steinitz lost against the Evans attack played by Tchigorin, the talented Russian player. Moreover, our opinion is further confirmed by the fact that Zukertort—than whom there is no greater authority on this opening—contrary to his expressed opinion, *did not accept the Gambit against Tchigorin*, but declined it, and won.

We therefore follow in the footsteps of a great master in giving wise preference to discretion before valour. We will examine the result of declining the Gambit, before dealing with the Opening itself.

Black.



White.

4. B to Kt3

The only safe way of playing, and which ought to yield Black a fair defence. White has now two moves at his disposal, viz.:

5.	P to QR4, or	P to Kt5.
If 5.	P to QR4	P to QR3
6.	Castles	P to Q3
7.	P to R5	B to R2
8.	P to Kt5	P × P
9.	B × KtP	Kt to K2
10.	P to Q4	P × P
11.	Kt × P	B to Q2

with a fair game.

White can vary his play on the sixth move in this variation by playing 6. P to B3, Kt to B3. 7. Q to Kt3, Castles, &c., but with careful play Black ought to obtain a safe game. It is, however, different if White adopts the more attacking move of 5. P to Kt5; although this gives rise to complicated positions, yet with best play Black ought to obtain an advantage.

5. P to Kt5 Kt to R4
6. Kt × P

Now Black would not do well to play B to Q5, as the following variation will show: 6. B to Q5. 7. Kt × BP, Q to B3. 8. Q to K2, Kt × B. 9. Kt × R, B × R. 10. Q × Kt, Kt to K2. 11. P to QB3, and White will remain with a P more.

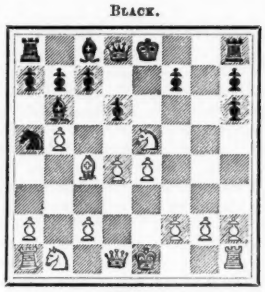
6. Kt to R3

White would not do well to play now the likely-looking move of 7. B to Kt2, for then Black plays P to Q3. 8. Kt to Q3 (best) (for if 8. Kt to KB3, Kt to Kt5) 8. Kt × B. 9. B × P, R to Kt sq. 10. B × Kt, Q to R5, with the better game. Therefore

7. P to Q4 P to Q3
8. B × Kt P × B

Now White can play either Kt × P or B × P (ch), or Q to B3 or R5

Black.



White.

(*a*) 9. Kt × P Q to B3
10. Kt × R Kt × B
11. P to QB3 B to K3

with the better game, as the Kt cannot escape.

(*b*) 9. B × P (ch) K to K2
10. Q to R5 P × Kt
11. B to Q5 Q to Q3
12. P × P Q to Kt3

and although White has three Pawns for the piece, Black's game is good.

(*c*) If 9. Q to B3, R to B sq. 10. B × P (ch), K to K2. 11. Kt to QB3, B to K3, and Black has the best game.

Finally, if 9. Q to R5, Q to B3. 10. Kt × P, Kt × B. 11. Kt × R (ch), K to K2. 12. Kt to B3, B to K3. 13. Kt to Q5 (ch), B × Kt. 14. Q × B, Kt to R6, and Black must win.

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

J. J. Cridlin.—We may write on odds some day. For the present we can only recommend you to play 1. P to Q3, followed by 2. Kt to KB3 when giving P, and move 1. P to K4, 2. P to Q4, 3. P to QB3, and 4. B to B4 (if feasible), when giving odds of Kt, and a King's Gambit when giving the Rook; but if you think you have a strong and steady player to beat, then you must play very close, very hard, and very slow.

S. B. C.—1. Kt to K4 (ch), K to Kt3. 2. B to B5 (ch), K to R4. 3. B to R4 (ch), K × P. 4. Kt checks on B3 or 5, K escapes on Kt 6 or 5 accordingly.

Correct solutions received:—Problem 129, W. No. 130, W. Hanrahan. No. 131, W. Packer, Geo. W. Thompson, A. J. Champ, George Gouge, W., H. A. N., Z. Gibson, S. B. C., J. J. Cridlin.

"Tree Gossip" is the title of a new book by Mr. Francis George Heath, to be published shortly at the Leadenhall Press by Messrs. Field & Tuer.

The electric light is a great boon to fruit-growers near the cities in California. At Los Angeles, it is reported, several bushels of moths are killed every night, while at Sacramento it is believed that the blackbeetle has been nearly exterminated.

A Money-washing machine will soon be amongst the hygienic requirements. *Science et Nature* has raked up another danger in the matter which collects on coins which have been a long time in circulation. M. Reinsch, of Erlangen, has devoted much study to this matter, and has investigated old and recent coins of all metals from all the European States. Everywhere he has found micro-organisms of Algæ and Bacteria. Scraping away the matter which accumulates in the interstices of the relief with a needle, and placing it in a drop of distilled water under a microscope of 250 to 300 diameters, he found fragments of textile fibres, numerous starchy granules, especially of the starch of wheat, globules of grease, some unicellular Algæ, &c. But when a microscope of greater power was used, Bacteria were found among this detritus. There were long Bacteria with a vibratory or spiral movement, as well as those of a globular shape. Sometimes both forms were found on one coin, but as a rule each form was found separately.

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